PELHAM RENAMING EFFORT
FORT MCCLELLAN, ALABAMA
IFB NO.:AC-23-B-0016-S

PROJECT MANUAL

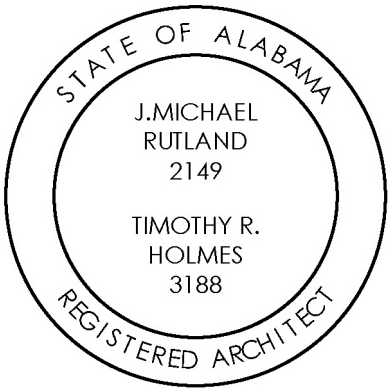
JOB NO.: 23-1299
DATE:
SET NO.:

[redacted]

JMR+H
Architecture, PC

445 Dexter Avenue
Suite 5050
Montgomery, Al 36104

Phone: (334) 420-5672
Fax: (334) 420-5692



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PELHAM RENAMING EFFORT
FORT MCCLELLAN, ALABAMA
IFB NO.: AC-23-B-0016-S

PROJECT MANUAL

[redacted]

SECTION 00 01 03 - PROJECT DIRECTORY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Identification of project team members and their contact information.

1.02 OWNER:

A. Name: Armory Commission of Alabama
   1. Address: 1720 Cong. W.L. Dickinson Drive
   2. City: Montgomery
   3. State: AL
   4. Zip Code: 36109

1.03 CONSULTANTS:

A. Architect: Design Professional of Record. All correspondence from the Contractor regarding construction documents authored by Architect's consultants will be through this party.
   1. Company Name: JMR+H Architecture, PC
      a. Address : 445 Dexter Avenue, Suite 5050
      b. City: Montgomery
      c. State: Alabama
      d. Zip Code: 36104
      e. Telephone: 334-420-5672
   2. Primary Contact:
      a. Title: Architect
      b. Name: Robert Garris
      c. Telephone: 334-420-5672
      d. Email: rgarris@jmrha.com

B. Structural Engineering Consultant:
   1. Company Name: LBYD Engineers
      a. Address: 318 N. College Street, Suite E
      b. City: Auburn
      c. State: Alabama
      d. Zip Code: 36830

C. Mechanical Engineering Consultant - Plumbing & Mechanical:
   1. Company Name: Whorton Engineering
      a. Address: 25 Summerall Gate Road, Bldg. 2102
      b. City: Anniston
      c. State: Alabama
      d. Zip Code: 36205

D. Electrical Engineering Consultant:
   1. Company Name: McCarter Engineering
      a. Address: 878 Avalon Lane
      b. City: Anniston
      c. State: Alabama
      d. Zip Code: 36207

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

SECTION 00 01 07

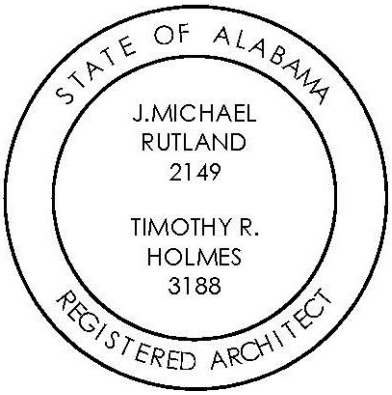
PROFESSIONAL SEALS

Project Specifications for:

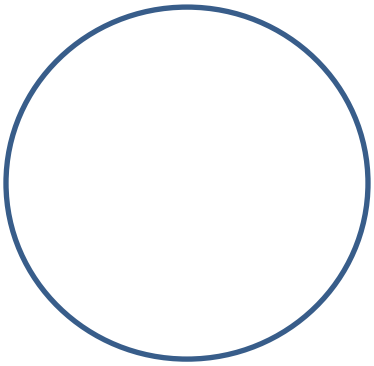
PELHAM RENAMING EFFORT
FORT McCLELLAN, ALABAMA

Owner:
Armory Commission of Alabama
1720 Congressman WL Dickinson Drive
Montgomery, AL 36109

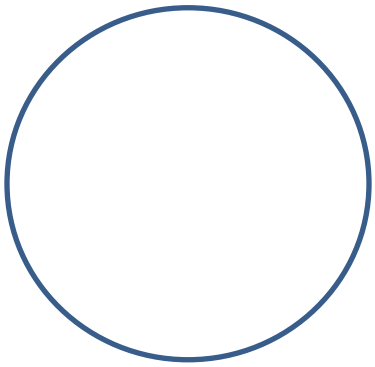
Architect:
JMR+H Architecture, PC
445 Dexter Avenue, Suite 5050
Montgomery, AL 36104



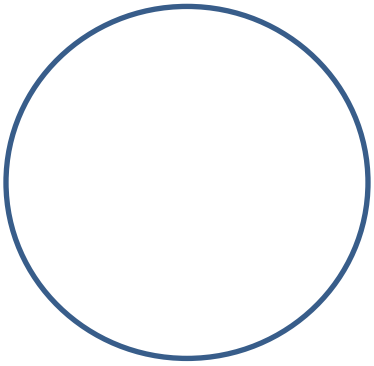
ARCHITECTURAL



STRUCTURAL



MECHANICAL



ELECTRICAL

SECTION 00 01 10 - TABLE OF CONTENTS

PROCUREMENT AND CONTRACTING REQUIREMENTS

Division 00 -- Procurement and Contracting Requirements

SPECIFICATIONS

Division 01 -- General Requirements

DIVISION 2 – EXISTING CONDITIONS

END OF SECTION

INDEX OF DRAWINGS

SEQ. NO.	DWG. NO	SHEET TITLE
1	T1.1	COVER, INDEX, LEGENDS AND NOTES
		BID ITEM A
2	BI.A/D1.1	GUARD SHACK DEMOLITION PLAN / PHOTOS (ALTERNATE #1)
3	BI.A/A1.1	MONUMENT SIGN
4	BI.A/A1.2	EXTERIOR SIGNAGE
		ELECTRICAL
5	BI.A/E1.1	SYMBOLS, NOTES AND LIGHTING FIXTURE SCHEDULES
6	BI.A/E2.1	SCHEDULES, LIGHTING PLAN, SINGLE LINE DIAGRAM, SITE PLAN AND DETAILS
		BID ITEM B
7	BI.B/L1.1	TOPO / LANDSCAPE PLAN
8	BI.B/C1.1	SITE PLAN
9	BI.B/A1.1	FIRST FLOOR DIMENSIONAL PLAN
10	BI.B/A1.2	FIRST FLOOR KEY & SYMBOL PLAN
11	BI.B/A1.3	PLAN DETAILS
12	BI.B/A1.4	PLAN DEATILS
13	BI.B/A2.1	FINISH SCHEDULE, FIRE PIT DETAILS
14	BI.B/A3.1	DOOR & WINDOW SCHEDULE
15	BI.B/A4.1	EXTERIOR ELEVATIONS
16	BI.B/A5.1	BUILDING SECTIONS
17	BI.B/A6.1	WALL SECTIONS
18	BI.B/A6.2	WALL SECTIONS
19	BI.B/A6.3	WALL SECTIONS
20	BI.B/A6.4	WALL SECTIONS
21	BI.B/A7.0	LARGE SCALE PLANS, CABINET SECTIONS
22	BI.B/A7.1	INTERIOR ELEVATIONS
23	BI.B/A8.1	REFLECTED CEILING PLAN
24	BI.B/A9.1	ROOF PLAN
25	BI.B/A10.1	FURNITURE PLAN
		STRUCTURAL
26	BI.B/S1.1	FOUNDATION PLAN
27	BI.B/S1.2	FOUNDATION DETAILS
28	BI.B/S2.1	ROOF FRAMING
		MECHANICAL
29	BI.B/P1.1	PLUMBING SCHEDULES, LEGEND, AND NOTES
30	BI.B/P1.2	PLUMBING DETAILS
31	BI.B/P2.1	WASTE AND CONDENSATE PLUMBING PLAN
32	BI.B/P2.2	WATER AND GAS PLUMBING PLAN
33	BI.B/P3.1	WASTE PLUMBING RISER DIAGRAM
34	BI.B/P3.2	WATER PLUMBING RISER DIAGRAM
35	BI.B/SP1.1	FIRE SPRINKLER PLUMBING PLAN
36	BI.B/M1.1	HVAC LEGEND, NOTES, AND SCHEDULES
37	BI.B/M1.2	HVAC SCHEDULES AND DETAILS
38	BI.B/M2.1	HVAC DETAILS
39	BI.B/M3.1	HVAC PLAN
		ELECTRICAL
40	BI.B/E1.1	SYMBOLS, NOTES, AND LIGHTING FIXTURE SCHEDULE
41	BI.B/E2.1	SINGLE LINE DIAGRAM, SCHEDULES, DETAILS AND SITE PLAN
42	BI.B/E3.1	LIGHTING, POWER AND AUXILIARIES PLANS
		BID ITEM C
43	BI.C/D1.1	DEMOLITION PLAN
44	BI.C/D2.1	DEMOLITION PHOTOS

ADVERTISEMENT FOR BIDS
PELHAM RENAMING EFFORT
ANNISTON, ALABAMA

Sealed bids will be received by The Armory Commission of Alabama, at the State Military Department Building, 1720 Cong. W.L. Dickinson Drive, (P.O. Box 3711), Montgomery, Alabama, until 2:00 p.m., Central Time, Thursday, September 21, 2023, for Pelham Renaming Effort, Anniston, AL (IFB# AC-23-B-0016-S), at which time they will be publicly opened and read in the Second Floor Classroom (Room 201), of the State Military Department, 1720 Cong. W.L. Dickinson Drive, Montgomery, Alabama.

Certified checks or bid bonds (Power of Attorney is required) payable to The Armory Commission of Alabama in an amount not less than five (5) per cent of the amount of the bid, but in no event more than $10,000.00 per project, must accompany the bidder's proposal. Completed Disclosure Statements are preferred to accompany the proposal. Performance and Payment bonds will be required at the signing of the contract.

All entities must be registered to do business in the State of Alabama. All bidders bidding in amounts exceeding $50,000.00 must be licensed under the provisions of Title 34, Chapter 8, Code of Alabama, 1975.

Plans and specifications are open to public inspection at the State Military Department, 1720 Cong. W.L. Dickinson Drive, State Property and Disbursing Office, Montgomery, AL 36109. Point of contact: Eric Holt, kenneth.e.holt2.nfg@army.mil.

Plans and specifications may be obtained from the Architects, JMR+H Architecture, Attn: Renae Williams, specs@jmrha.com, upon deposit of $500.00 per set, which will be refunded in full upon return of documents in good condition within ten (10) calendar days of the bid date. Questions should be addressed, in writing, to Renae Williams at JMR+H Architecture, specs@jmrha.com no later than 2:00 p.m. CT, Wednesday September 13, 2023.

Only those bidders who have officially received “Bid Documents” from JMR+H Architecture, will be included on the distribution lists as “official plan holders” for Addenda or other project information during the bidding period. Any prospective bidders other than “official plan holders” must notify, in writing, JMR+H Architecture of their intent to bid the project by 2:00 p.m., CDT, Wednesday September 13, 2023.

A Pre-Bid Conference will be conducted at 1:30 p.m., Wednesday, September 6, 2023, at FMTC Building 2299, Anniston, Alabama. All bidders are strongly encouraged to attend. Any errors or omissions made as a result of not attending will not be grounds for additional compensation.

MARK A. WEEKS
State Property and Disbursing Officer

SECTION 00 21 00 - INSTRUCTIONS TO BIDDERS

1. INTENT OF INSTRUCTION:

   Instructions to Bidders are included in the Contract Documents to amplify the invitation for Bids, which is abbreviated because of cost and space limitations, and to five other details which interested parties must or should know in order to prepare bids properly.

2. PREQUALIFICATION OF BIDDERS:

   Bidders for work costing in excess of $50,000.00 must be licensed under the terms of existing State laws. In case of a joint venture of two or more contractors, the amount of the bid shall be within the maximum bid limitation as set by the State Licensing Board for General Contractors of the combined limitations of the partners to the joint venture. Before award of any Contract, any Bidder may be required to file under oath with the Commission a complete Confidential Financial Statement, Equipment Questionnaire, and Experience Questionnaire on forms that will be furnished by the Contracting Officer with the request. If the applicant is a corporation organized in a state other than Alabama, it shall furnish a certificate from the Secretary of State showing that it is qualified to transact business in Alabama.

   Copies of the Contract Documents may be obtained from the Contracting Officer, as stated in the Invitation For Bids.

3. EXAMINATION OF CONTRACT DOCUMENTS AND OF THE SITE OF THE WORK:

   Before submitting a proposal for the work, the bidders shall carefully examine the Contract Documents, visit the site, and satisfy themselves as to the nature and location of the Work, and the general and local conditions, including weather, the general character of the site or building, the character and extent of existing work within or adjacent to the site, and any other work being performed thereon at the time of submission of their bids. They shall obtain full knowledge as to transportation, disposal, handling, and storage of materials, availability of water, electric power, and all other facilities in the area which will have a bearing on the performance of the Work for which they submit their proposals. The submission of a proposal shall be prima facie evidence that the bidder has made such examination and visit and has judged for and satisfied himself as to conditions to be encountered regarding the character, difficulties, quality and quantities of work to be performed and the material and equipment to be furnished, and as to the contract requirements and contingencies involved.

   If, in the performance of the Contract, subsurface or latent conditions are found to be materially different from those indicated by the Drawings and Specifications, or unknown conditions of an unusual or impractical nature are disclosed differing materially from conditions usually inherent in work of the character shown and specified, the attention of the Engineer shall be called immediately to such conditions before they are disturbed. Upon such notice, or upon observation of conditions, the Engineer will promptly make such changes in the Drawings and/or Specifications as he finds necessary to conform to the different conditions, and any increase or decrease in the cost of the Work resulting from such changes will be adjusted as provided under CHANGES IN THE WORK or EXTRA WORK as set forth in the GENERAL CONDITIONS.

4. EXPLANATIONS AND INTERPRETATIONS:

   Should any bidder observe any ambiguity, discrepancy, omission, or error in the Drawings and Specifications, or in any other Contract Document, or be in doubt as to the intention and meaning thereof, he should at once report such to the Engineer and request clarification, in writing, with a copy of his request to the Contracting Officer. Clarification will be made only by written addenda sent to all prospective bidders. Neither the Engineer, nor the Contracting Officer will be responsible in any manner for verbal answers regarding intent or meaning of the Contract Documents, or for any verbal instructions, by whomsoever made, prior to the award of the Contract.

   Should conflict occur in or between Drawings and Specifications, a bidder will be deemed to have estimated on the more expensive way of doing the work involved unless he shall have asked for and

obtained the written decision of the Engineer before submission of his bid as to method, materials, or equipment which will be required.

5. CONTENTS OF PROPOSAL FORMS:

The Contracting Officer as stated in the advertisement, will furnish bidders blank bid forms for the work contemplated, indicating the lump sum bid items, alternate bid items, and unit price bid items.

6. LIQUIDATED DAMAGES:

Time is the essence of the Contract and the bidder's attention is called to that clause of the GENERAL CONDITIONS which requires the deduction of a stipulated time charge equal to six percent interest per annum on the total Contract Price for the work for the entire period that any part of the work remains uncompleted after the time specified in the Contract documents for completion of the work which will be deducted by the Contracting Officer from the final estimate and retained by the Owner out of the moneys otherwise due the Contractor in the final payment, not as a penalty but as liquidated damages sustained by the Owner.

7. PREPARATION OF BID:

The bid must be submitted on the bid form furnished by the Owner or Contracting Officer as stated in the Invitation for Bids.

The bid shall be properly signed by the bidder. If the bidder is an individual, his name and post office address must be shown; if a firm or partnership, the name and post office address of each member of the firm or partnership must be shown; if a corporation, the President, Vice-President, or Secretary shall sign and affix the corporate seal, or if the person signing the bid is an agent, the said agent must attach written authorization from the President, Vice-President or Secretary of the corporation, and the bid must show the name of the corporation, the name of the state under the laws of which the corporation is chartered and the names, titles, and business address of the officers.

8. BID GUARANTY:

No bid submitted will be considered unless accompanied by a certified check or bid bond made payable to the Owner in an amount not less than five percent (5%) of the Contractor's bid, but in no event more than ten thousand dollars ($10,000.00), as a guaranty that the bidder will enter into a contract with the Owner for the Performance of the work and furnish contract bonds for the work if it be awarded to him.

9. DELIVERY OF BIDS:

Each Bid shall be placed, together with Bid Guaranty, in a sealed envelope on the outside of which is written in large letters "Bid" and so marked as to identify the Work bid on and the name of the Bidder. Bid may be delivered in person, or by mail if ample time is allowed for delivery. When sent by mail, preferable special delivery or registered, the sealed Bid marked as indicated above, shall be enclosed in another envelope for mailing. Bid will be received at the place stated and until the hour of the date set in Invitation for Bids for their opening unless notice is given of postponement. No Bid will be accepted or considered which has not been received prior to the hour of the opening date.

10. WITHDRAWAL OR REVISION OF BIDS:

A Bid may be withdrawn at any time prior to the hour fixed for opening of Bids, provided a request in writing executed by the Bidder or his duly authorized representative is filed with the Contracting Officer prior to that time, in which case such Bid, when received will be returned to the Bidder unopened. Telegrams or written communications to correct Bid will be accepted and the Bid corrected in accordance therewith if received by the Contracting Officer prior to the hour set in the Invitation for Bids. No Bid shall be withdrawn, modified, or corrected after the hour set for opening such Bid.

11. OPENING OF BIDS:

Bids will be opened and read publicly at the time and place indicated in the Invitation for Bids. Bidders or their authorized agents are invited to be present.

12. IRREGULAR BID:

Bids may be rejected if they contain any omissions, alterations of forms, additions not called for, conditional bids, alternate bids unless called for, incomplete bids, erasures, or irregularities of any kind. Bids in which the unit or lump sum prices bid are obviously unbalanced may be rejected.

13. ERRORS IN BID:

In case or error in the extension of prices, the unit price will govern. In case of discrepancy between the prices shown in the figures and in words, the words will govern.

14. DISQUALIFICATION OF BIDDERS:

Any Bidder using the same or different names for submitting more than one Bid upon any unit, portion, part or section of work will be disqualified from further consideration on that part of the Work. Evidence that any bidder is interested, as a principal, in more than one Bid for the Work (for example, bidding in a partnership; as a joint partnership or association and as a Partnership, association, or individual) will cause the rejection of any such Bid. A Bidder may, however, submit a Bid as a principal and as a subcontractor to some other principal, or may submit a Bid as a subcontractor to as many other principals as he desires, and by so doing will not be liable to disqualification.

If there is reason for believing that collusion exists among the bidders any or all Bids may be rejected, and participants in such collusion may not be considered in future Bids for the same work. Bids in which prices are obviously unbalanced or unresponsive to the Invitation for Bids may be rejected.

The right is reserved to reject a Bid from Bidder who has not paid, or satisfactorily settled, all bills due for labor and material on former contracts in force at the time of letting.

15. CONSIDERATION OF BIDS:

After the Bids are opened and read, the Bid prices will be compared, and the results of such comparison will be made public. Until the final award of the Contract, however, the Owner reserves the right to reject any all Bids, and to accept or reject any or all items of any bid and to waive technical errors and any informality if, in his judgement, the best interests of the Owner will thereby be promoted.

16. DETERMINATION OF LOW BIDDER:

The low bidder will be determined by the total Bid of all Items on the bid form that are accepted.

17. AWARD OF CONTRACT:

The Contract will be awarded to the lowest responsible bidder complying with all established requirements of the Contract Documents unless the Owner finds that his bid is unreasonable or that it is not in the interest of the Owner to accept it, and subject to the Owner'' right to award on the basis of any bid item or any combination of bid items. A bidder to whom award is made will be notified at the earliest possible date.

18. RETURN OF BID GUARANTIES:

All Bid Guaranties, except those of the three lowest bona fide bidders, will be returned immediately after Bids have been checked, tabulated, and the relation of the Bid established. The Bid Guaranty of the three lowest bidders will be returned as soon as the Contract Bonds and the Contract of the successful Bidder have been properly executed and approved. Should no award be made within thirty days, all Bids will be rejected, and all guaranties returned, unless the successful Bidder agrees

in writing to a stipulated extension in time for consideration of his bid, in which case the Owner may, at his discretion, permit the successful Bidder to substitute a satisfactory bidder’s bond for the certified check submitted with his Bid as a Bid Guaranty.

19. EXECUTION OF CONTRACT:

The Contract shall be signed by the successful Bidder, in the number of counterparts provided in the Contract Agreement, and returned to the Contracting Officer with satisfactory Contract Bonds.

20. REQUIREMENTS OF CONTRACT BONDS:

In order to insure the faithful performance of each and every condition, stipulation, and requirement of the Contract and to indemnify and save harmless the Owner from any and all damages, either directly or indirectly (arising out of any failure to perform same), the successful Bidder to whom the Contract is awarded shall furnish at his expense and file with the Contracting Officer an acceptable Surety Bond in the amount equal to one hundred (100) per cent of the Contract Price of the Contract as awarded. Said Bond shall be made on the approved Bond form, shall be furnished by a surety company duly authorized and qualified to make such bonds in the State of Alabama, shall be countersigned by an authorized agent resident in the State who is qualified for the execution of such instruments, and shall have attached thereto power of attorney of the signing official. In case of default on the part of the Contractor, all expenses incident to ascertaining and collecting losses suffered by the State under the Bond, the direct costs of administration, architectural, engineering, and legal services, shall lie against the Contract Bond for Performance of the Work.

In addition thereto, the successful Bidder to whom the Contract is awarded shall furnish at his expense and file with the Contracting Officer another Bond with good and sufficient surety payable to the Owner in an amount equal to fifty (50) per cent of the Contract Price, with the obligation that the Contractor shall promptly make payment to all persons furnishing him or them with labor, materials, equipment, or supplies for or in prosecution of the Work provided for in the Contract and for the payment of reasonable attorneys fees incurred by successful claimants or plaintiffs in suits on said Bond.

21. APPROVAL OF CONTRACT:

No Contract is binding upon the Owner until it has been executed by the Contracting Officer and approved by the Chief National Guard Bureau, and/or the State Building Commission as required by Federal and State laws and regulations.

22. FAILURE TO EXECUTE CONTRACT:

Should the successful Bidder or Bidders to whom a Contract is awarded fail to execute a Contract and furnish acceptable Contract Bonds within ten days following the date of Award, the Owner shall retain form the Proposal Guaranty if it be a certified check or recover from the Principal of the Sureties if the guaranty be a bond the difference between the amount of the Contract as awarded and the amount of the proposal of the next lowest bidder. If no other bids are received, the full amount of the Proposal Guaranty shall be so retained or recovered as liquidated damages for such default. Any sums so retained or recovered shall be the property of the Owner. In the event of the death of the low bidder (if an individual and not a partnership or corporation) between the date of the opening of bids and the ten days following the date of award of Contract allowed for furnishing the Contract Bonds, the Owner shall return the Proposal Guaranty intact to the estate of the deceased low bidder.

Failure by the Owner to complete the execution of a Contract and to issue a Notice to Proceed within thirty (30) days after its Presentation by the Contractor shall be just cause, unless both parties agree in writing to a stipulated extension in time for issuance of a Notice to Proceed, for withdrawal of the Contractor’s bid and Contract Agreement without forfeiture of a certified check or bond.

SECTION 00 41 00 – PROPOSAL FORM
(Revision Date: 12 Jan 2021)

IFB # AC-23-B-0016-S
BID OPENING DATE: September 21, 2023
BIDDER _____
CONTRACTOR'S LICENSE NO. _____

TO: The Armory Commission of Alabama
State Military Property and Disbursing Officer
Headquarters, Alabama National Guard
1720 Cong. W.L. Dickinson Drive
Montgomery, Alabama 36109-0711

PROJECT: PELHAM RENAMING EFFORT
FORT McCLELLAN, ALABAMA
IFB# AC-23-B-0016-S

In compliance with your Invitation for Bids dated 25 August 2023, the undersigned hereby proposes to furnish the plant, labor, materials, and equipment and perform all work for the above-described project in strict accordance with the specifications, drawings, and addenda number _____ for consideration of the following prices (bid prices do NOT include Sales or Use Taxes in accordance with Act 2013-205):

BID

PERFORM ALL WORK IN ACCORDANCE WITH THE DRAWINGS & SPECIFICATIONS FOR:
PELHAM RENAMING FMTC BUILDING 1026 CONSTRUCTION, FORT MCCLELLAN, ALABAMA.

BID ITEM A: (Installation of new Monument Sign at Pelham Range Entrance) **$**_____

Bid Item A- Alternate No. 1: (Demolition of the former Guard Shack $_____

BID ITEM B: (Complete construction of new Transient Training Officers' Quarters Building 1026.) **$**_____

BID ITEM C: (Complete demolition of existing FMTC Building 1026.) **$**_____

ACCOUNTING OF SALES TAX

Pursuant to Act 2013-205, section 1(g) the Contractor accounts for sales tax NOT in the bid form as follows:

ESTIMATED SALES TAX AMOUNT

BID ITEM A: (Installation of new Monument Sign at Pelham Range Entrance) **$**_____

Bid Item A – Alternate No. 1: (Demolition of the former Guard Shack $_____

BID ITEM B: (Complete construction of new Transient Training Officers' Quarters Building 1026.) **$**_____

BID ITEM C: (Complete demolition of existing FMTC Building 1026.) **$**_____

Failure to provide an accounting of sales tax shall render the bid non-responsive. Other than determining responsiveness, sales tax accounting shall not affect the bid pricing nor be considered in the determination of the lowest responsible and responsive bidder.

TIME LIMIT: These bids are subject to an acceptance period of thirty (30) days.

A. All amounts and totals given will be subject to verification by the State. In case of variation between unit bid price and total shown by bidder, the unit price will be considered to be his bid. The State reserves the right to award the work on the basis of any bid or any combination of bids and to increase or decrease the quantities of any item listed in this bid at the price quoted for that particular item.

B. Bids shall be for the entire work and shall have each blank space filled in to include the "Estimated Sales Tax Accounting".

C. The quantities of each item of the bid as finally ascertained at the close of the contract will determine the total payment to accrue under the contract.

D. The bidder, upon request of written notice of award of the contract within thirty (30) days after the date of opening of bids, agrees that he will execute the construction contract in accordance with this bid as accepted, and if the consideration of the contract will exceed $50,000.00 in amount, will furnish to the State a Performance Bond and a Payment Bond on AGO Forms, with good and sufficient surety or sureties as required by the specifications, at the time the contract is executed.

E. It is hereby warranted that in the event award is made to the undersigned, there will be furnished under this contract or used in the performance of the work covered by this contract, only such unmanufactured articles, materials, and supplies as have been mined or produced in the United States, and only such manufactured articles, materials, or supplies mined, produced or manufactured, as the case may be, in the United States, except as indicated in the bid documents..

F. The bidder further agrees that if awarded the contract, he will commence work within ten (10) calendar days after notice to proceed date and that he will fully complete the work ready for use not later than **250 calendar days** after notice to proceed date.

FIRM NAME _____

ADDRESS _____

_____

PHONE _____

FAX _____

EMAIL _____

BY _____
SIGNATURE

PRINTED NAME_____

TITLE _____

STATE OF ALABAMA
CONTRACTOR'S LICENSE NO. _____

NOTES:
All bidders must be licensed under the provisions of Title 34, Chapter 8, Code of Alabama, 1975, as amended.

On projects bid at $50,000.00 or more, the bidder must include his license number on the bid form in the prescribed place and on the outside of the envelope containing the bid, or otherwise the bid will not be considered.

Bid Prices do not include Sales or Use Taxes but these taxes are identified in the Estimated Sales Tax Amount section of this bid form.

SECTION 00 43 00 - FORM OF BID BOND

BID BOND

A completed/executed Standard Bid Bond form (Building Commission Form, AIA Form, GSA Standard Form, etc,) [A Power of Attorney is **REQUIRED** for all Bid Bonds] or a certified check made payable to the Armory Commission of Alabama in an amount not less than five (5) percent of the Contractor's bid, but in no event more than ten thousand dollars ($10,000.00), must accompany all bids greater than $50,000.00.

END OF SECTION

SECTION 00 43 25 - SUBSTITUTION REQUEST FORM DURING BIDDING

(BIDDERS SHALL USE THIS FORM FOR SUBMITTING SUBSTITUTION REQUESTS DURING BIDDING. OTHER FORMS OF SUBSTITUTION REQUESTS WILL NOT BE CONSIDERED. THIS FORM MUST BE RECEIVED BY ARCHITECT NOT LATER THAN 7 WORKING DAYS PRIOR TO BID OPENING DATE)

Project: Pelham Renaming Effort
Fort McClellan, Alabama **Substitution Request Number: _____**
IFB Project No.: IFB #: AC-23-B-0016-S Re: _____

From: _____
Specification Title: _____ Section: _____
Description: _____ Page: _____ Article/Paragraph: _____
Proposed Substitution:_____
Manufacturer: _____ Address: _____ Phone: _____
Trade Name: _____ Model No.: _____
Installer: _____ Address: _____ Phone: _____

History: New Product 1 – 4 years old 5 – 10 years old Exceeds 10 years old

Differences between proposed substitution and specified product: _____
_____
_____

Point by Point comparative data attached – REQUIRED BY ARCHITECT

Reason for not providing specified item:_____
_____
_____

Similar Installation:
Project: _____ Architect: _____
Address: _____ Owner: _____
_____Date Installed: _____
Proposed substitution affects other parts of Work: ___No ___Yes
Explain_____
_____
_____

Savings to Owner for accepting substitution:_____ ($ _____)

Proposed substitution changes Contract Time: ___No ___Yes [Add] [Deduct] _____ days.

Supporting Data Attached:
Drawings Product Data Samples Tests Reports _____

The Undersigned Certifies:

Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.

Same warranty will be furnished for proposed substitution as for specified product.

Same maintenance service and source of replacement parts, as applicable, is available.

Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.

Cost data as stated above is complete. Claims for additional costs related to accepted substitution which may subsequently become apparent are to be waived.

Proposed substitution does not affect dimensions and functional clearances.

Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.

Coordination, installation, and changes in the Work as necessary for accepted substitution will be complete in all respects.

Submitted By: _____ Signed By: _____

Firm:

_____

Address:

_____

_____

Telephone: _____ Fax: _____

E-mail: _____ Website: _____

Attachments:

_____

_____

END OF SECTION

SECTION 00 45 19 – DISCLOSURE STATEMENT

State of Alabama
Disclosure Statement

(Required by Act 2001-955)

ENTITY COMPLETING FORM

ADDRESS

CITY, STATE, ZIP | TELEPHONE NUMBER ( )

STATE AGENCY/DEPARTMENT THAT WILL RECEIVE GOODS, SERVICES, OR IS RESPONSIBLE FOR GRANT AWARD

Armory Commission of Alabama

ADDRESS

1720 Congressman W. L. Dickinson Drive

CITY, STATE, ZIP | TELEPHONE NUMBER

Montgomery, AL 36109 | (334) 271-7274

This form is provided with:

☐ Contract ☐ Proposal ☐ Request for Proposal ☐ Invitation to Bid ☐ Grant Proposal

Have you or any of your partners, divisions, or any related business units previously performed work or provided goods to any State Agency/Department in the current or last fiscal year?

☐ Yes ☐ No

If yes, identify below the State Agency/Department that received the goods or services, the type(s) of goods or services previously provided, and the amount received for the provision of such goods or services.

STATE AGENCY/DEPARTMENT	TYPE OF GOODS/SERVICES	AMOUNT RECEIVED

Have you or any of your partners, divisions, or any related business units previously applied and received any grants from any State Agency/Department in the current or last fiscal year?

☐ Yes ☐ No

If yes, identify the State Agency/Department that awarded the grant, the date such grant was awarded, and the amount of the grant.

STATE AGENCY/DEPARTMENT	DATE GRANT AWARDED	AMOUNT OF GRANT

1. List below the name(s) and address(es) of all public officials/public employees with whom you, members of your immediate family, or any of your employees have a family relationship and who may directly personally benefit financially from the proposed transaction. Identify the State Department/Agency for which the public officials/public employees work. (Attach additional sheets if necessary.)

NAME OF PUBLIC OFFICIAL/EMPLOYEE	ADDRESS	STATE DEPARTMENT/AGENCY

OVER

SECTION 00 45 19 – DISCLOSURE STATEMENT

2. List below the name(s) and address(es) of all family members of public officials/public employees with whom you, members of your immediate family, or any of your employees have a family relationship and who may directly personally benefit financially from the proposed transaction. Identify the public officials/public employees and State Department/Agency for which the public officials/public employees work. (Attach additional sheets if necessary.)

NAME OF FAMILY MEMBER	ADDRESS	NAME OF PUBLIC OFFICIAL/ PUBLIC EMPLOYEE	STATE DEPARTMENT/ AGENCY WHERE EMPLOYED

If you identified individuals in items one and/or two above, describe in detail below the direct financial benefit to be gained by the public officials, public employees, and/or their family members as the result of the contract, proposal, request for proposal, invitation to bid, or grant proposal. (Attach additional sheets if necessary.)

Describe in detail below any indirect financial benefits to be gained by any public official, public employee, and/or family members of the public official or public employee as the result of the contract, proposal, request for proposal, invitation to bid, or grant proposal. (Attach additional sheets if necessary.)

List below the name(s) and address(es) of all paid consultants and/or lobbyists utilized to obtain the contract, proposal, request for proposal, invitation to bid, or grant proposal:

NAME OF PAID CONSULTANT/LOBBYIST	ADDRESS

By signing below, I certify under oath and penalty of perjury that all statements on or attached to this form are true and correct to the best of my knowledge. I further understand that a civil penalty of ten percent (10%) of the amount of the transaction, not to exceed $10,000.00, is applied for knowingly providing incorrect or misleading information.

Signature Date

Notary's Signature Date Date Notary Expires

Act 2001-955 requires the disclosure statement to be completed and filed with all proposals, bids, contracts, or grant proposals to the State of Alabama in excess of $5,000.

CONTRACT NO. AC-23-B-0016-S

00 52 00 - CONSTRUCTION CONTRACT FORM

STATE OF ALABAMA

THE ARMORY COMMISSION OF ALABAMA

CONSTRUCTION CONTRACT

OWNER:	**THE ARMORY COMMISSION OF ALABAMA** **P.O. BOX 3711** **MONTGOMERY, ALABAMA 36109-0711**
CONTRACTOR:	**(Contractor's Name)** **(Street Address)** **(City, State Zip)**
CONTRACT FOR:	**PELHAM RENAMING EFFORT**
CONSTRUCTION LOCATION:	**FORT MCCLELLAN, ALABAMA**
AMOUNT:	**(Dollar Amount)**
PAYMENT TO BE MADE BY:	**STATE OF ALABAMA**

FEDERAL:

STATE:

00 52 00 - CONSTRUCTION CONTRACT FORM

CONTRACT AGREEMENT FOR CONSTRUCTION

THIS AGREEMENT, entered into this **(day)** day of **(month) (year)** by and between The Armory Commission of Alabama (hereinafter called the Owner), and **(Contractor Name)**(hereinafter called the Contractor).

WITNESSETH that the Owner and the Contractor, in consideration of premises of the mutual covenants, considerations, and agreements herein contained, agree as follows:

STATEMENT OF WORK: The Contractor shall furnish all labor and materials and perform all work for **(Project Name)** in strict and entire conformity with the plans and specifications dated **(Date)** prepared by **(Architect/Engineer)** and approved by The Armory Commission, including Addenda thereto numbered **(Number)**, all of which are hereby made a part of this agreement as fully and to the same effect as if the same had been set forth at length in the body of this Agreement.

TIME OF COMPLETION: The work shall be commenced on a date to be specified in a written proceed order of the Contracting Officer and shall be completed within **(# of Days)** from and after said date as provided in the Contract documents.

COMPENSATION TO BE PAID: The Owner will pay and the Contractor will accept in full consideration for the performance of the Work, subject to additions and deductions (including liquidated damages) as provided in the Contract Documents, the sum of **(Contract Amount),** being the amount of the Contractor's bid for the aforesaid work, including bid items **(Awarded Items).** The Contractor and the Owner for themselves, their successors, executors, administrators, and assigns, hereby agree to the full performance of the covenants herein contained.

COMPLIANCE WITH ADDITIONAL STATE REQUIRED CLAUSES: By signing this contract, the Contractor hereby certifies compliance and agreement with the following clauses required by the State of Alabama:

1. In compliance with Act No. 2012-491, the contracting parties affirm, for the duration of the agreement, that they will not violate federal immigration law or knowingly employ, hire for employment, or continue to employ an unauthorized alien within the state of Alabama. Furthermore, a contracting party found to be in violation of this provision shall be deemed in breach of the agreement and shall be responsible for all damages resulting therefrom;

2. In compliance with Act 2016-312, the Contractor hereby certifies that it is not currently engaged in, and will not engage in, the boycott of a person or an entity based in or doing business with a jurisdiction with which this state can enjoy open trade;

3. In compliance with the merit system exclusion clause, the Contractor

understands and agrees that the Contractor is not to be considered a State of Alabama merit system employee and is not entitled to any benefits of the State Merit System;

4. By entering into this contract, the Contractor is not an agent of the state, its officers, employees, agents or assigns. The Contractor is an independent entity from the State and nothing in this agreement creates an agency relationship between the parties.

IN WITNESS WHEREOF, the Parties hereto and on the day and year first above written have executed this Agreement in Three counterparts, each of which shall without proof or accounting for the other counterparts, be deemed as original thereof.

This Contract was let in accordance with the provisions of Title 39, Code of Alabama 1975 as amended, and applicable sections of Department of Defense Armed Services Procurement Regulation. The terms and commitments of this Contract do not constitute a debt of the State of Alabama in violation of Article 11, Section 213 of the Constitution of Alabama, 1901, as amended by Amendment Number 26.

00 52 00 - CONSTRUCTION CONTRACT FORM

WITNESSES:

CONTRACTING PARTIES:

_____

(Contractor's Name) _____
Contractor

_____

_____
(Signature)

This contract has been reviewed for legal form and complies with all applicable laws, rules, and regulations of the State of Alabama governing these matters.

_____
JAMES R. HOUTS
Deputy Attorney General

This contract has been reviewed for and is approved as to content.

_____
MARK A. WEEKS
State Property & Disbursing Officer

NOTE: If the Contractor is a corporation, witnesses are not required, but the annexed certificate must be completed. Type or print names under all signatures.

00 52 00 - CONSTRUCTION CONTRACT FORM

ATTEST:

The Armory Commission of Alabama

MARK A. WEEKS
Secretary
The Armory Commission

SHERYL E. GORDON
Major General, ALNG
The Adjutant General

ATTEST:

APPROVED:

JOHN H. MERRILL
Secretary of State of Alabama

KAY IVEY
Governor, State of Alabama

00 52 00 - CONSTRUCTION CONTRACT FORM

CERTIFICATE

I,_____, certify that I am the _____ of the corporation named as Contractor herein; that ___xxxxxxxxx._____, who signed this contract on behalf of the Contractor, was then the ___xxxxxxxxx___ of said corporation; that said Contractor was duly signed for and in behalf of said corporation by authority of its governing body, and is within the scope of its corporate powers.

(S E A L) _____

NOTE: Contractor, if a corporation, should cause the above certificate to be executed under its corporate seal. THE SAME OFFICER SHALL NOT EXECUTE BOTH THE CONTRACT AND THE CERTIFICATE.

NOTE: In the event that the Contractor is not a corporation, the signature page must be witnessed by two individuals and this page may be left blank.

SECTION 00 61 13 - PERFORMANCE BOND FORM

AGO Form 215 (16 Apr 80) (MOD JUL 87) (Page 1 of 3) PERFORMANCE BOND (See Instructions Attached)	DATE BOND EXECUTED
PRINCIPAL (Legal name and business address)	TYPE OF ORGANIZATION ("X" Out) ____ Individual ____ Partnership ____ Joint Venture ____ Corporation State of Incorporation _____
SURETY(IES) (Name and business address)	
Penal Sum of Bond (Express in words & figures)	
Contract Number	Contract Date

KNOW ALL MEN BY THESE PRESENTS, That we, the Principal and Surety(ies) hereto, are firmly bound to the Armory Commission of Alabama in the above penal sum for the payment of which we bind ourselves, our heirs, executors, administrators, and successors, jointly and severally: *Provided,* That, where the Sureties are corporations acting as co-sureties, we, the Sureties, bind ourselves in such sum "jointly and severally" as well as "severally" only for the purpose of allowing a joint action or actions against any or all of us, and for all other purposes each Surety binds itself, jointly and severally with the Principal, for the payment of such sum only as is set forth opposite the name of such Surety, but if no limit of liability is indicated, the limit of liability shall be the full amount of the penal sum.

THE CONDITION OF THIS OBLIGATION IS SUCH, that whereas the Principal entered into the contract identified above:

NOW, THEREFORE, if the Principal shall:

(a) Perform and fulfill all the undertakings, covenants, terms, conditions, and agreements of said contract during the original term of said contract and any extensions thereof that may be granted by the Armory Commission of Alabama through its Contracting Officer, with or without notice to the Surety(ies), and during the life of any guaranty required under the contract, and shall also perform and fulfill all the undertakings, covenants, terms, conditions, and agreements of any and all duly authorized modifications of said contract that may hereafter be made, notice of which modifications to the Surety(ies) being hereby waived; and

(b) PROVIDED, further, that upon the failure of the said PRINCIPAL to promptly and efficiently prosecute said Work, in any respect, in accordance with the Contract Documents, the above bound Surety(ies) shall take charge of said work and complete the Contract at his/their own expense, pursuant to its terms, receiving, however, any balance of the funds in the hands of said The Armory Commission of Alabama due under said contract.

(c) The Invitation for Bids, Instructions to Bidders, Proposal, General and Special Conditions of the Contract, Detailed Specification Requirements, and Drawings, and the Contract Agreement hereinbefore referred to, and the Bond for the Payment of Labor, Materials, Food-stuffs, or Supplies executed under the provision of Chapter 1, Title 39, Alabama Code of 1975, are made a part of this obligation, and this instrument is to be construed in connection therewith.

(d) If the said contract is subject to the Miller Act, as amended (40 U.S. Code 270a-270e), pay to the U.S. of America the full amount of the taxes imposed by the U.S. Government which are collected, deducted, or withheld from wages paid by the Principal in carrying out the construction contract with respect to which this bond is furnished; then the above obligation shall be void and of no effect.

IN WITNESS WHEREOF, the Principal and Surety(ies) have executed this performance bond and have affixed their seals on the date set forth above.

PRINCIPAL			
Signatures(s)	1. (Seal)	2. (Seal)	Corporate Seal
Name(s) & Title(s) (Types)			

CORPORATE SURETY(IES)					
Surety A	Name & Address (Typed)		State of Inc.	Liability Limit	Corporate Seal
	Signature(s)	1.	2.		
	Names(s) & Title(s) (Typed)	1.	2.		
Surety B	Name & Address (Typed)		State of Inc.	Liability Limit	Corporate Seal
	Signature(s)	1.	2.		
	Names(s) & Title(s) (Typed)	1.	2.		

Bond Premium	Rate Per Thousand	Total
	_____	_____

AGO Form 215 (16 Apr 80) (Page 3 of 3)
(MOD JUL 87) INSTRUCTIONS

1. This form is authorized for use in connection with contracts for construction work or the furnishing of supplies or services. There shall be no deviation from this form without approval by the Armory Commission of Alabama.

2. The full legal name and business address of the Principal shall be inserted in the space designated "Principal" on the second page of this form. The bond shall be signed by an authorized person. Where such person is signing in a representative capacity (e.g., an attorney-in-fact), but is not a member of the firm, partnership, or joint venture, or an officer of the corporation involved, evidence of his authority must be furnished.

3. Corporations executing the bond as sureties must be licensed to do business in the State of Alabama. Where more than a single corporate surety is involved, their names and addressed (city and state) shall be inserted in the spaces (Surety A, Surety B) headed "CORPORATE SUETY(IES)", and in the space designated "SURETY(IES)" on the front page of this form, only the letter identification of the Sureties shall be inserted. Evidence of authority must be attached.

4. Corporations executing the bond shall affix their corporate seals. Individuals shall execute the bond opposite the word "Seal".

5. The name of each person signing this performance bond should be typed in the space provided.

END OF SECTION

SECTION 00 61 16 - PAYMENT BOND FORM

AGO Form 214 PAYMENT BOND 5 AUG 82 (MOD 29 JUL 87) Page 1 of 2 (See Instructions Attached)	Date bond executed
PRINCIPAL (Legal name and business address)	TYPE OF ORGANIZATION ("X" Out) ____ Individual ____ Partnership ____ Joint Venture ____ Corporation State of Incorporation _____
SURETY (IES) (Name and Business Address)	
Penal Sum of Bond (Express in words & figures)	
Contract No.:	Contract Date:

KNOW ALL MEN BY THESE PRESENTS, That we, the Principal and Surety(ies) hereto, are firmly bound to the Armory Commission of Alabama in the above penal sum for the payment of which we bind ourselves, our heirs, executors, administrators, and successors, jointly and severally: *Provided,* That, where the Sureties are corporations acting as co-sureties, we, the Sureties, bind ourselves in such sum "jointly and severally" as well as "severally" only for the purpose of allowing a joint action or actions against any or all of us, and for all other purposes each Surety binds itself, jointly and severally with the Principal, for the payment of such sum only as is set forth opposite the name of such Surety, but if no limit of liability is indicated, the limit of liability shall be the full amount of the penal sum.

THE CONDITION OF THIS OBLIGATION IS SUCH, that whereas the Principal entered into the contract identified above:

NOW, THEREFORE, if the Principal shall promptly make payment to all persons supplying labor, equipment or supplies, and material in the prosecution of the work provided for in said contract and all duly authorized modifications of said contract that may hereafter be made, notice of which modifications to the Surety(ies) being hereby waived, then the above obligation shall be void and of no effect; otherwise to remain and be in full force and effect.

PROVIDED, further, in the event that the said Principal, as such Contractor, shall fail to make prompt payment to all persons supplying him or them with labor, materials, feed-stuffs, or supplies for or in the prosecution of the Work provided for in such Contract, the above bound Surety(ies) shall be liable for the payment of reasonable attorney's fees incurred by successful claimants or plaintiffs in suits on said bond as provided in Chapter 1, Title 39, Code of Alabama 1975.

PROVIDED, further, that said Principal and Surety hereby agree and bind themselves to the mode of service described in Chapter 1, Title 39, Code of Alabama 1975, and consent that such service shall be the same as personal service on said Principal or Surety.

AGO Form (5 Aug 82) (Page 2 of 2)
(MOD 29 Jul 87)

IN WITNESS WHEREOF, the Principal and Surety(ies) have executed this payment bond and have affixed their seals on the date set forth above.

PRINCIPAL			
Signature(s)	1. (Seal)	2. (Seal)	Corporate Seal
Name(s) & Title(s) (Typed)			

CORPORATE SURETY(IES)					
Surety A	Name & Address (Typed)		State of Inc.	Liability Limit	Corporate Seal
	Signature(s)	1.	2.		
	Name(s) & Title(s) (Typed)	1.	2.		
Surety B	Name & Address (Typed)		State of Inc.	Liability Limit	Corporate Seal
	Signature(s)	1.	2.		
	Name(s) & Title(s) (Typed)	1.	2.		

Bond Premium	Rate Per Thousand _____	Total _____

INSTRUCTIONS

1. This form, for the protection of persons supplying labor and material, shall be used whenever a payment bond is required under the act of Aug 24, 1935, 49 Stat. 793, as amended (40 U.S.C. 270a-270e). There shall be no deviation from this form without approval by the Armory Commission of Alabama.
2. The full legal name and business address of the Principal shall be inserted on the space designated "Principal" on this form. The bond shall be signed by an authorized person. Where such person is signing in a representative capacity (e.g. an attorney-in-fact), but is not a member of the firm, partnership, or joint venture, or an officer of the corporation involved, evidence of his authority must be furnished.
3. Corporations executing the bond as sureties must be licensed to do business in the State of Alabama. Where more than a single corporate surety is involved, their names and addresses (city and state) shall be inserted in the spaces (Surety A, Surety B, etc.) headed "CORPORATE SURETY(IES)", and in the space of the Sureties shall be inserted. Evidence of authority must be attached.
4. Corporations executing the bond shall affix their corporate seals. Individuals shall execute the bond opposite the word "Seal".
5. The name of each person signing this payment bond should be typed in the space provided.

END OF SECTION

CONTRACTORS PERIODICAL REQUEST FOR PARTIAL PAYMENT (Rev 12 MAR 2019)

PROJECT TITLE: _____ **LOCATION:** _____

CONTRACT NUMBER: _____ **NOTICE TO PROCEED DATE:** _____

OWNER: THE ARMORY COMMISSION OF ALABAMA, P.O. BOX 3711, MONTGOMERY, AL 36109

CONTRACTOR: _____

ADDRESS: _____

FEDERAL IDENTIFICATION NUMBER: _____ **INVOICE DATE:** _____

PARTIAL PAYMENT NO. _____ **FINAL Pay Req? Yes** ___ **/ No** ___ **PERIOD COVERED:** _____

Item #	Description	Contract Price	Percent Complete	Amount Complete
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
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21				
22				
23				
24				
25				
26				
27				
28				
29				
30				
31				
32				
33				
34				
35				
TOTAL ORIGINAL CONTRACT		**$0.00**		**$0.00**
Net Total of ALL Change Orders/Supplements No.	to			
TOTAL CONTRACT TO DATE		**$0.00**		**$0.00**

Page: 1 of 2

Brought Forward TOTAL CONTRACT TO DATE	$ 0.00	% Completed	$0.00
Stored Materials: (List)			
Amount of Stored Materials (*)		$0.00	$0.00
Total Completed & Stored Materials			$0.00
Less Retainage (5% up to 50% of Contract Amount)			$0.00
Total Due			$0.00
Total Previous Payments			
BALANCE DUE THIS PAYMENT			$0.00

* As stored materials are incorporated in the finished work, their value shall be deducted from Previous Stored Materials.

I certify that the above account is correct, just and that payment therefore has not yet been received.

Sworn to and subscribed before me this

day of 20 CONTRACTOR

(Do NOT Type Above Information - Handwritten Date Info ONLY)

BY:

(Notary Public) (Signature)

Printed Name:

My Commission Expires: Title:

VERIFICATIONS AND APPROVALS

Checked by: Date:

Architect/Architect's Representative

Reviewed by: Date:

Project Manager

Approved by: Date:

Contracting Officer/Contracting Officer's Representative

CHANGE ORDER DETAIL SHEET **FOR PARTIAL PAY REQUEST NO. _____**

CO #	Description	Contract Price	Percent Complete	Amount Complete
Net Total of ALL Change Orders/Contract Mods FROM #	**TO #**	**$0.00**		**$0.00**

THE ARMORY COMMISSION
OF ALABAMA
P.O. Box 3711
MONTGOMERY, ALABAMA 36109-0711

State Property and Disbursing Office May 27, 2014

MEMORANDUM FOR ALL Architect-Engineer Firms Preparing Bid Documents for Armory Commission of Alabama and ALL Project Managers

SUBJECT: Act 2013-205, Certificate of Exemption from Sales and Use Tax for Armory Commission Contracts

1. Act 2013-205 was signed into law on May 9,2013, granting the Alabama Department of Revenue (ADOR) the authority to issue certificates of exemption from sales and use taxes for construction projects for certain governmental agencies. Enclosed are a Memo from Alabama Department of Revenue regarding the Sales Tax Exemption guidance and a copy of Act 2013-205.

2. A brief summary of Act 2013-205 as it pertains to Armory Commission Contracts is provided below:

a. ADOR shall issue certificates of exemption from sales and use tax to The Armory Commission of Alabama for each tax exempt project. The Armory Commission shall apply for certificates of exemption for each project. The contractor must also apply for certificates of exemption for each project for which they receive a contract.
b. Certificates of exemption shall only be issued for contracts entered into (awarded) on or after 1JAN14.
c. Certificates shall only be issued to contractors licensed by the State Licensing Board for General Contractors or any subcontractor working under the same contract.
d. Items eligible for exemption from sales and use tax are building materials, construction materials and supplies and other tangible personal property that become part of the structure per the written construction contract.
e. ADOR will handle the administration of certificates of exemption and the accounting of exempt purchases. ADOR will have the ability to levy fines and may bar the issuance or use of certificates of exemption upon determination of willful misuse by the contractor or a subcontractor.
f. The contractor shall account for the tax savings on the bid form by providing the estimated sales taxes for each item in the appropriate area on the bid form.

3. Contractors will NOT include sales taxes in their bids on the bid proposal form. Contractors **MUST** however include the estimated sales taxes for each listed bid item in the area identified on their bid proposal forms. This “accounting” for sales tax on the bid proposal form is required by Act 2013-205, Section 1 (g). Bid proposal forms with base bids and separate alternate bids will follow this procedure. The bid forms shall be modified for each project by the architect or engineer as appropriate to insure that EACH bid item is listed with NO sales taxes and then a separate area identifying the

estimated sales taxes for EACH of these items is identified and listed on the bid proposal form.

4. **Failure of the contractor to complete the attachment to the bid proposal form indicating the sales tax as required by Act 2013-205, Section 1 (g) shall render the bid non-responsive.**

5. Architects will address these tax reporting requirements in all future pre-bid conferences and will further prepare addenda which will inform all current plan holders of this tax exemption policy for the upcoming bid openings in June 2014.

6. It is the responsibility of the "contractor" to ensure they comply with Act 2013-205.

7. All future projects will include this information in the Instructions to Bidders. Should you have additional questions or need further information, please contact me by email mark.a.weeks3.nfg@mail.mil or phone (334) 271-7275.

Respectfully,

Enclosures

MARK A. WEEKS
Contracting Officer and Secretary,
The Armory Commission of Alabama

JULIE P. MAGEE
Commissioner

State of Alabama
Department of Revenue
(www.revenue.alabama.gov)
50 North Ripley Street
Montgomery, Alabama 36132

MICHAEL E. MASON
Assistant Commissioner
JOE W. GARRETT, JR.
Deputy Commissioner
CURTIS E. STEWART
Deputy Commissioner

Alabama Department of Revenue
NOTICE

Tax Guidance for Contractors, Subcontractors and Alabama Governmental Entities Regarding Construction-related Contracts

Legislative Act 2013-205 requires the Department of Revenue to issue Form STC-1, *Sales and Use Tax Certificate of Exemption for Government Entity Projects,* to all contractors and subcontractors working on qualifying governmental entity projects once the Form ST: EXC-01 is approved.

Each exempt entity, contractor and subcontractor must make application for qualification of the exemption using Form ST: EXC-01 for each tax-exempt project. The application is available on the department's website at http://revenue.alabama.gov/salestax/ST-EXC-01.pdf. Applications should be submitted directly to the Sales and Use Tax Division Central Office, P.O Box 327710, Montgomery, AL 36132-7710.

The sales and use tax exemption provided for in Act 2013-205 applies to the purchase of building materials, construction materials and supplies, and other tangible personal property that become part of the structure pursuant to a qualifying contract entered into on or after January 1, 2014. Qualifying projects and contracts are those generally entered into with the following governmental entities, unless otherwise noted: the State of Alabama, a county or incorporated municipality of Alabama, an Alabama public school, or an Alabama industrial or economic development board or authority already exempt from sales and use taxes. **Please note that contracts entered into with the federal government and contracts pertaining to highway, road, or bridge construction or repair do not qualify for the exemption provided for in Act 2013-205.** [Reference: Sales and Use Tax Division Administrative Rule 810-6-3-.77 *Exemption for Certain Purchases by Contractors and Subcontractors in Conjunction with Construction Contracts with Certain Governmental Entities.*]

The Alabama Department of Revenue will assign each contractor and sub-contractor a consumers use tax account, if one is currently not in place, at the time the Form STC-1, Sales *and Use Tax Certificate of Exemption for Government Entity Projects*, is issued.

Contractors and sub-contractors for qualifying projects will be required to file monthly consumers use tax returns and report all exempt purchases for ongoing projects, as well as all taxable purchases on one return. These returns are required to be filed through the department's online tax return filing and payment portal, My Alabama Taxes (https://myalabamataxes.alabama.gov).

As another option for these types of contracts, as well as with other contracts entered into with other types of exempt entities, the Form ST:PAA1, *Purchasing Agent Appointment*, may be used. However, please be advised that the use of the Form ST:PAA1 option will require the exempt entity to be invoiced directly and pay for directly from their funds any construction and building material and supply purchases.

For additional information concerning this guidance, taxpayers should contact Sales and Use Tax Division representative Thomas Sims at 334-242-1574 or by email at Thomas.Sims@revenue.alabama.gov.

ACT 2013 - 205

HB419

150466-6

By Representative DeMarco

RFD: Ways and Means Education

First Read: 07-MAR-13

ENROLLED, An Act,

Relating to construction projects of the State of Alabama, counties, municipalities, local boards of education, industrial development boards, and other governmental entities which are exempt from the payment of sales and use taxes on the purchase of building materials and construction materials to be included in construction projects of the governmental entity; to provide for the Department of Revenue to grant certificates of exemption from sales and use taxes to contractors and subcontractors licensed by the State Licensing Board for General Contractors for the purchase of building materials and construction materials to be used in the construction of a building or other project for the governmental entity, with the exception of any highway, road, or bridge project; to provide for accounting for purchases and enforcement for violation of the act; and to authorize the Department of Revenue to adopt rules to implement the act.

BE IT ENACTED BY THE LEGISLATURE OF ALABAMA:

Section 1. (a) For the purposes of this act, the ~~term "governmental entity" means any governmental entity or a political subdivision, department, or agency of a governmental entity or a board, commission, or authority of a governmental entity which is tax exempt from sales and use taxes by virtue of its governmental status, including, but not limited to, all~~

~~of the following: The State of Alabama, a county, a municipality, an industrial or economic development board or authority, and an educational institution of any of the foregoing including a public college or university, a county~~ term "governmental entity" means the State of Alabama and its political subdivisions, including a county, a municipality, and an industrial or economic development board or authority. A governmental entity shall also include an educational institution of any of the foregoing Alabama political subdivisions including a public college or university, a county or city board of education, and the State Board of Education.

(b)(1) The Department of Revenue shall issue a certificate of exemption to the governmental entity for each tax exempt project.

~~(b)~~ (2) The Department of Revenue shall grant a certificate of exemption from state and local sales and use taxes to any contractor licensed by the State Licensing Board for General Contractors, or any subcontractor working under the same contract, for the purchase of building materials, construction materials and supplies, and other tangible personal property that becomes part of the structure that is the subject of a written contract for the construction of a building or other project, not to include any contract for the construction of any highway, road, or bridge, for and on

behalf of a governmental entity which is exempt from the payment of sales and use taxes.

(c) The use of a certificate of exemption for the purchase of tangible personal property pursuant to this section shall include only tangible personal property that becomes part of the structure that is the subject of the construction contract. Any contractor or subcontractor purchasing any tangible personal property pursuant to a certificate of exemption shall maintain an accurate cost accounting of the purchase and use of the property in the construction of the project.

(d) A contractor who has an exemption from sales and use tax for the purchase of materials to use on a government project shall file, in a manner as prescribed by the department, ~~an annual report~~ reports of all exempt purchases. The ~~annual report~~ reports shall be filed as a prerequisite to renewal of a certificate of exemption.

(e)(1) The department may assess any contractor or subcontractor with state and local sales or use taxes on any item purchased with a certificate of exemption not properly accounted for and reported as required.

(2) Any contractor or subcontractor who intentionally uses a certificate of exemption in violation of this act shall, in addition to the actual sales or use tax liability due, be subject to a civil penalty levied by the

department in the amount of not less than a minimum of two thousand dollars ($2,000) or two times any state and local sales or use tax due for the property and, based on the contractor's or subcontractor's willful misuse of the certificate of exemption, may be barred from the use of any certificate of exemption on any project for up to two years.

(f) The department may adopt rules to implement this act in order to effectuate the purposes of this act and to provide for accurate accounting and enforcement of this act.

(g) In bidding the work on a tax exempt project, the bid form shall provide for an accounting for the tax savings.

(h) The intent of this act is to lower the administrative cost for the governmental entity, contractor, and subcontractor for public works projects. It is not the intent of this act to change the basis for determining professional services from fair market value, which may include sales and use taxes.

Section 2. This act shall be operative for contracts entered into ~~October 1, 2013~~ January 1, 2014, or thereafter, and shall not apply to any contract entered into prior to January 1, 2014. In addition, this act shall not apply to any contract change orders or contract extensions, including revised, renegotiated, or altered contracts, when the original contract was entered into prior to January 1, 2014. The

Department of Revenue may adopt rules to implement this act after the effective date of this act.

Section 3. All laws or parts of laws which conflict with this act are repealed.

Section 4. This act shall become effective October 1, 2013, following its passage and approval by the Governor, or its otherwise becoming law.

Speaker of the House of Representatives

Kay Ivey

President and Presiding Officer of the Senate

House of Representatives

I hereby certify that the within Act originated in and was passed by the House 09-APR-13, as amended.

Jeff Woodard
Clerk

Senate	07-MAY-13	Amended and Passed
House	09-MAY-13	Concurred in Senate Amendment

APPROVED May 9, 2013

TIME 5 pm

Robert Bentley
GOVERNOR

Alabama Secretary Of State

Act Num....: 2013-205
Bill Num...: H-419

Recv'd 05/10/13 09:48amSLF

NSOR Marco

SPONSORS

SALES TAX ABATEMENT

00 62 77 – 11

HOUSE ACTION

I HEREBY CERTIFY THAT THE RESOLUTION AS REQUIRED IN SECTION C OF ACT NO. 81-889 WAS ADOPTED AND IS ATTACHED TO THE BILL, H.B. 419

YEAS 84 NAYS 6

JEFF WOODARD, Clerk

I HEREBY CERTIFY THAT THE NOTICE & PROOF IS ATTACHED TO THE BILL, H.B. ______ AS REQUIRED IN THE GENERAL ACTS OF ALABAMA, 1975 ACT NO. 919.

JEFF WOODARD, Clerk

CONFERENCE COMMITTEE

House Conferees ______

SENATE ACTION

DATE: 4-11 **20**13

RD 1 RFD F+TE

This Bill was referred to the Standing Committee of the Senate on F+TE

and was acted upon by such Committee in session and is by order of the Committee returned therefrom with a favorable report w/amend(s) 1 w/sub ___ by a vote of yeas 9 nays ___ abstain 0 this 24 day of April 2013

______, Chairperson

DATE: 4-24 **20**__

RF FAV ___ **RD 2 CAL**

DATE: ______ **20**__

RE-REFERRED RE-COMMITTED

Committee ______

I hereby certify that the Resolution as required in Section C of Act No. 81-889 was adopted and is attached to the Bill, HB 419.

YEAS 21 **NAYS** 7

PATRICK HARRIS,
Secretary

INVENTORY OF STORED MATERIALS

Project: PELHAM RENAMING EFFORT

For Period Ending _____

Contractor: _____

A	B	C	D	E	F
DESCRIPTION	MATERIALS STORED LAST PERIOD	PURCHASED THIS PERIOD	TOTAL COLUMNS B + C	MATERIALS USED THIS PERIOD	MATERIALS PRESENTLY STORED

To be used as documentation to support value of Stored Materials reported on CONTRACTOR'S PERIODICAL REQUEST FOR PARTIAL PAYMENT.

00 62 83 CONTRACTOR'S DRAW SCHEDULE

Date Prepared: _________________

Project Name: **PELHAM RENAMING EFFORT**

Contract Number: ________________________

Contractor: _____________________________

Architect/Engineer: ______________________

This draw schedule is to be updated monthly and the most current version **MUST** be submitted with each Contractor's Periodical Request for Partial Payment.

CURRENT MONTH/YEAR						
PROJECTED DRAW						
ACTUAL DRAW						
TOTAL AMOUNT OF DRAWS	0	0	0	0	0	0
CURRENT MONTH/YEAR						
PROJECTED DRAW						
ACTUAL DRAW						
TOTAL AMOUNT OF DRAWS	0	0	0	0	0	0
CURRENT MONTH/YEAR						
PROJECTED DRAW						
ACTUAL DRAW						
TOTAL AMOUNT OF DRAWS	0	0	0	0	0	0
CURRENT MONTH/YEAR						
PROJECTED DRAW						
ACTUAL DRAW						
TOTAL AMOUNT OF DRAWS	0	0	0	0	0	0

00 63 56 – WEATHER DELAY DOCUMENTATION FORM

To:
JMR+H Architecture, PC
445 Dexter Avenue, Suite 5050
Montgomery, Al 36104
(334) 420-5672
(334) 420-5692

From:
Contractor Name
Contractor Address
Contractor City, State Zip
Contractor Phone
Contractor Fax

PROJECT: (Name and address)	PELHAM RENAMING EFFORT FORT McCLELLAN, ALABAMA	IFB PROJECT NO.	(Leave Blank)
		AC-23-B-0016-S	
TO OWNER: (Name and address)	Armory Commission of Alabama 1720 Cong. W. L Dickinson Dr. Montgomery, Alabama 36109	DATE OF ISSUANCE:	(Contractor Add Date)

NOTICE OF WEATHER DELAYS:
FOR THE MONTH OF YEAR:

This Monthly Notice is to document Weather Delays for the referenced project in order to formally present a Change Order Request for extension of the Contract Time.

The table below defines the monthly anticipated adverse weather for the contract period for exterior work and is based upon National Weather Service Climatological Data for the geographic location for the Project.

MONTHLY ANTICIPATED ADVERSE WEATHER – CALENDAR DAYS

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX

Based on the above data for the geographic location of this Project, the monthly anticipated adverse weather calendar days for MONTH is XX.

From our Daily Project Reports and Recorded Weather Data, it has been determined that the Project experienced XX days of adverse weather resulting in a partial or complete stoppage of work. The total of XX days exceeds the normal adverse weather days at this Project site for this month by X days. Therefore we respectfully request that the Contract Time be extended by X net days.
TOTAL NET DAYS REQUESTED FOR Month OF Year _____

TOTAL NET DAYS REQUESTED FOR PROJECT TO DATE: _____

TOTAL NET DAYS APPROVED BY OWNER FOR PROJECT TO DATE: _____

NOTE: The purpose of this form is to document Adverse Weather Days during the course of the Project. It does not relieve the Contractor of his responsibility to complete the Project in a timely manner and as scheduled.

FORM OF ADVERTISEMENT OF COMPLETION

LEGAL NOTICE

In accordance with Chapter 1, Title 39, Code of Alabama, 1975, notice is hereby given that ____**Contractor**___ has completed the Contract for ___**Project Name**___), ___**Contract #**___, located at ___**City, State**___, for the Armory Commission of Alabama, Owner, and have made request for final settlement of said Contract. All persons having any claim for labor, materials or otherwise in connection with this project should immediately notify the Armory Commission of Alabama, P.O. Box 3711, Montgomery, Alabama 36109-0711.

_____

Contractor

_____

Business Address

NOTE: This notice must be run once a week for four successive weeks. Proof of publication is required.

CERTIFICATE OF PUBLICATION

STATE OF ALABAMA

COUNTY OF _____

Before me, _____, a Notary Public, in and for said County, personally appeared _____, who duly sworn, deposes and says that he/she is the **PUBLISHER** of the _____ _____, a newspaper published weekly in _____, _____ County, Alabama, and that the _____ _____ _____ _____ a copy of which is attached hereto, was published in said newspaper for _____ consecutive weeks, commencing in the issue of _____ (date), and ending in the issue of _____ (date).

_____

Publisher

Sworn to and subscribed before me this _____ day of _____, 20_____.

_____

Notary Public

AIA® Document G706™ – 1994

Contractor's Affidavit of Payment of Debts and Claims

PROJECT: *(Name and address)*	**ARCHITECT'S PROJECT NUMBER:**	OWNER: ☐
x	00000-00	ARCHITECT: ☐
	CONTRACT FOR: General Construction	CONTRACTOR: ☐
TO OWNER: *(Name and address)*	**CONTRACT DATED:** January 07, 2005	SURETY: ☐
		OTHER: ☐

STATE OF:
COUNTY OF:

The undersigned hereby certifies that, except as listed below, payment has been made in full and all obligations have otherwise been satisfied for all materials and equipment furnished, for all work, labor, and services performed, and for all known indebtedness and claims against the Contractor for damages arising in any manner in connection with the performance of the Contract referenced above for which the Owner or Owner's property might in any way be held responsible or encumbered.

EXCEPTIONS:

SUPPORTING DOCUMENTS ATTACHED HERETO:

1. Consent of Surety to Final Payment. Whenever Surety is involved, Consent of Surety is required. AIA Document G707, Consent of Surety, may be used for this purpose

Indicate Attachment ☐ Yes ☒ No

The following supporting documents should be attached hereto if required by the Owner:

1. Contractor's Release or Waiver of Liens, conditional upon receipt of final payment.
2. Separate Releases or Waivers of Liens from Subcontractors and material and equipment suppliers, to the extent required by the Owner, accompanied by a list thereof.
3. Contractor's Affidavit of Release of Liens (AIA Document G706A).

CONTRACTOR: *(Name and address)*

BY: _____
(Signature of authorized representative)

_____
(Printed name and title)

Subscribed and sworn to before me on this date:

Notary Public:
My Commission Expires:

AIA® Document G706A™ – 1994

Contractor's Affidavit of Release of Liens

PROJECT: *(Name and address)* x	**ARCHITECT'S PROJECT NUMBER:** 00000-00 **CONTRACT FOR:** General Construction	OWNER: ☐ ARCHITECT: ☐ CONTRACTOR: ☐
TO OWNER: *(Name and address)*	**CONTRACT DATED:** January 07, 2005	SURETY: ☐ OTHER: ☐

STATE OF:
COUNTY OF:

The undersigned hereby certifies that to the best of the undersigned's knowledge, information and belief, except as listed below, the Releases or Waivers of Lien attached hereto include the Contractor, all Subcontractors, all suppliers of materials and equipment, and all performers of Work, labor or services who have or may have liens or encumbrances or the right to assert liens or encumbrances against any property of the Owner arising in any manner out of the performance of the Contract referenced above.

EXCEPTIONS:

SUPPORTING DOCUMENTS ATTACHED HERETO:

1. Contractor's Release or Waiver of Liens, conditional upon receipt of final payment.
2. Separate Releases or Waivers of Liens from Subcontractors and material and equipment suppliers, to the extent required by the Owner, accompanied by a list thereof.

CONTRACTOR: *(Name and address)*

BY:

(Signature of authorized representative)

(Printed name and title)

Subscribed and sworn to before me on this date:

Notary Public:
My Commission Expires:

AIA® Document G707™ – 1994

Consent Of Surety to Final Payment

PROJECT: *(Name and address)* x	**ARCHITECT'S PROJECT NUMBER:** 00000-00	OWNER: ☐
	CONTRACT FOR: General Construction	ARCHITECT: ☐
TO OWNER: *(Name and address)*	**CONTRACT DATED:** January 07, 2005	CONTRACTOR: ☐
		SURETY: ☐
		OTHER: ☐

In accordance with the provisions of the Contract between the Owner and the Contractor as indicated above, the
(Insert name and address of Surety)

, SURETY,

on bond of
(Insert name and address of Contractor)

, CONTRACTOR,

hereby approves of the final payment to the Contractor, and agrees that final payment to the Contractor shall not relieve the Surety of any of its obligations to
(Insert name and address of Owner)

, OWNER,

as set forth in said Surety's bond.

IN WITNESS WHEREOF, the Surety has hereunto set its hand on this date:
(Insert in writing the month followed by the numeric date and year.)

_____
(Surety)

_____
(Signature of authorized representative)

Attest:
(Seal):

_____
(Printed name and title)

00 65 20 – CERTIFICATE OF FINAL COMPLETION FORM

CERTIFICATE OF FINAL COMPLETION

Distribution to:

JMR+H Architecture, PC
445 Dexter Avenue, Suite 5050
Montgomery, AL 36104
(334) 420-5672
(334) 420-5692

OWNER ☒
ARCHITECT ☒
CONTRACTOR ☒
OTHER ☒

PROJECT: (Name and address)	PELHAM RENAMING EFFORT FORT McCLELLEN, ALABAMA	IFB PROJECT NO.	AC-23-B -0016-S
TO OWNER: (Name and address)	Armory Commission of Alabama 1720 Cong. W. L Dickinson Dr. Montgomery, Alabama 36109	TO CONTRACTOR: (Name and address)	XXXXXXXXXXXXXXX XXXXXXXXXXXXXX XXXXXXXXXXXXXXX
DATE OF ISSUANCE:	DATE	CONTRACT TYPE: CONTRACT DATE:	General Construction MONTH DAY, YEAR

PROJECT OR DESIGNATED PORTION SHALL INCLUDE:
BRIEF PROJECT DESCRIPTION.

The Work performed under this Contract has been reviewed and found, to the Architect's best knowledge, information and belief, to be complete. Final Completion is the stage in the progress of the Work when the Work or designated portion thereof is complete in accordance with the Contract Documents so the Owner can occupy or utilize the Work for its intended use. The Date of Final Completion of the Project designated above is hereby established as the date of execution by the Owner as stated in the General Conditions, which is also the date of commencement of applicable warranties required by the Contract Documents.

The project is hereby certified by the Architect as completed.

A/E Name

Architect: By: NAME Date:

Contractor Name

Contractor: By: NAME (FROM CONTRACT) Date:

The Owner accepts the Work as complete and will assume full possession thereof at TIME on DATE.

Armory Commission of Alabama

Owner: By: AC Representative Name Date:

ABC Form C-9
August 2001

GENERAL CONTRACTOR'S ROOFING GUARANTEE

IFB No. _____
_____

Project Name & Address	Project Owner(s) & Address
PELHAM RENAMING EFFORT **FORT MCCLELLAN, ALABAMA**	

General Contractor's Name, Address, & Telephone Number	**EFFECTIVE DATES OF GUARANTEE**
	Date of Acceptance:
	Date of Expiration:

1. The General Contractor does hereby certify that the roofing work included in this contract was installed in strict accordance with all requirements of the plans and specifications and in accordance with approved roofing manufacturer's recommendations.

2. The General Contractor does hereby guarantee the roofing and associated work including but not limited to all flashing and counter flashing both composition and metal, roof decking and/or sheathing; all materials used as a roof substrate or insulation over which roof is applied; promenade decks or any other work on the surface of the roof; metal work; gravel stops and roof expansion joints to be absolutely watertight and free from all leaks, due to faulty or defective materials and workmanship for a period of five (5) years, starting on the date of substantial completion of the project. This guarantee does not include liability for damage to interior contents of building due to roof leaks, nor does it extend to any deficiency which was caused by the failure of work which the general contractor did not damage or did not accomplish or was not charged to accomplish.

3. Subject to the terms and conditions listed below, the General Contractor also guarantees that during the Guarantee Period he will, at his own cost and expense, make or cause to be made such repairs to, or replacements of said work, in accordance with the roofing manufacturers standards as are necessary to correct faulty and defective work and/or materials which may develop in the work including, but not limited to: blisters, delamination, exposed felts, ridges, wrinkles, splits, warped insulation and/or loose flashings, etc. in a manner pursuant to the total anticipated life of the roofing system and the best standards applicable to the particular roof type in value and in accordance with construction documents as are necessary to maintain said work in satisfactory condition, and further, to respond on or within three (3) calendar days upon proper notification or leaks or defects by the Owner or Architect.

A. Specifically excluded from this Guarantee are damages to the work, other parts of the

building and building contents caused by: (1) lightning, windstorm, hailstorm and other unusual phenomena of the elements; and (2) fire. When the work has been damaged by any of the foregoing causes, the Guarantee shall be null and void until such damage has been repaired by the General Contractor, and until the cost and expense thereof has been paid by the Owner or by the responsible party so designated.

B. During the Guarantee Period, if the Owner allows alteration of the work by anyone other than the General Contractor, including cutting, patching and maintenance in connection with penetrations, and positioning of anything on the roof, this Guarantee shall become null and void upon the date of said alterations. If the owner engages the General Contractor to perform said alterations, the Guarantee shall not become null and void, unless the General Contractor, prior to proceeding with the said work, shall have notified the Owner in writing, showing reasonable cause for claim that said alterations would likely damage or deteriorate the work, thereby reasonably justifying a termination of this Guarantee.

C. Future building additions will not void this guarantee, except for that portion of the future addition that might affect the work under this contract at the point of connection of the roof areas, and any damage caused by such addition. If this contract is for roofing of an addition to an existing building, then this guarantee covers the work involved at the point of connection with the existing roof.

D. During the Guarantee period, if the original use of the roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray cooled surface, flooded basin, or other use of service more severe than originally specified, this Guarantee shall become null and void upon the date of said change.

E. The Owner shall promptly notify the General Contractor of observed, known or suspected leaks, defects or deterioration, and shall afford reasonable opportunity for the General Contractor to inspect the work, and to examine the evidence of such leaks, defects or deterioration.

IN WITNESS THEREOF, this instrument has been duly executed this _____ day of _____, 20 _____.

_____

General Contractor's Authorized Signature

_____

Typed Name and Title

GENERAL CONDITIONS OF THE CONTRACT

CONTENTS

Paragraph No.

56. Equal Opportunity
57. Certification of Non-Segregated Facilities
58. Exemptions to Equal Opportunity Clauses
59. Clean Air and Water
60. Clean Air and Water Certification
61. Exemptions to Environmental Protection Clause
62. Affirmative Action for Handicapped Workers
63. Covenant Against Contingent Fees
64. Officials Not to Benefit
65. Convict Labor
66 Nondiscrimination in Employment
67. Gratuities
68. Copeland (Anti-Kickback) Act - Nondebate of Wages
69. Subcontracts -Termination
70. Audit by Department of Defense
71. Subcontractor Cost or Pricing Data - Price Adjustments
72. Buy American Act
73. Approval
74. Subject to Federal-State Agreement
75. Relationship of the Federal Government
76. Suspension of Work
77. Termination for Convenience of the Owner
78. Use of United States Flag Vessels
79. Debarment and Suspension
80. Nondiscrimination
81. Lobbying
82. Drug-Free Work Place
83. Environmental Standards
84. National Historic Preservation
85. Hatch Act
86. Cargo Preference
87. Relocation and Real Property Acquisition
88. Contract Work Hours and Safety Standards Act
89. Davis-Bacon Act
90. State Addendum

1. CONTRACT DOCUMENTS:

The Contract consists of the following CONTRACT DOCUMENTS, including all additions, deletions, and modifications incorporated therein before the execution of the Contract Agreement:

A. STATUTORY AND PROCEDURAL DOCUMENTS:

(1) Advertisement for Bids (Invitation for Bids)
(2) Instructions to Bidders (Information for Bidders)
(3) Proposal (Bid)
(4) Proposal Guaranty (Bidder's Bond)
(5) Contract Agreement
(6) Contract Bonds (Performance and Payment Bonds)

B. GENERAL CONDITIONS OF THE CONTRACT

C. DETAILED SPECIFICATION REQUIREMENTS

D. DRAWINGS

2. DEFINITIONS, INTENT, CORRELATION, AND STREAMLINING:

A. DEFINITIONS:

Wherever the following abbreviations and terms, or pronouns in place of them, are used in the Contract Documents, the intent and meaning shall be interpreted as follows:

(1) ARCHITECT: The architect, architectural firm, association, or corporation employed by the Owner, or, in case of the termination of his employment, his successor designated by the Owner, to furnish the working drawings and specifications in the Contract Documents, to prepare the Contract Documents, prepare details and explanatory drawings, and provide architectural instructions necessary for the execution of the Work, and to check and approve manufacturers' data and shop drawings and when so provided in his contract, to exercise general administration of the Contract under the direction of the Contracting Officer.

(2) BIDDER: The person, or persons, firm, partnership, association, corporation, or combination thereof, submitting a Bid for the Work, or any portion thereof, acting directly or through a duly authorized representative.

(3) COMMISSION: The Armory Commission of Alabama or any agency that may be designated by the Legislature as its successor.

(4) CONTRACT AGREEMENT: The written Contract Agreement executed between the Owner and the successful Bidder, covering the performance of the Work, by which the Contractor is bound to perform the Work and furnish the labor, materials and equipment under the terms of the Contract Documents, and by which the Owner is obligated to compensate him therefor at the mutually established and accepted rate or price, or as hereinafter provided.

(5) CONTRACT BONDS: The approved bonds furnished by the Contractor and his Surety to guarantee both completion of the Contract in accordance with the Contract Documents and prompt payment to all persons supplying him or them with labor, materials, supplies, etc.

(6) CONTRACTOR: The person or persons, firm, partnership, association or corporation, or combination thereof, that has entered into a Contract with the Owner for any work covered by the Contract Documents, acting directly or through his agents or employees.

(7) CONTRACTING OFFICER: The Contracting Officer of the Armory Commission, acting either upon his own initiative or through duly authorized representatives and inspectors, acting severally within the scope of the particular duties entrusted to them or the authority given them.

(8) MODIFICATIONS OF THE GENERAL CONDITIONS: Changes or modifications of the parts of the Armory Commission's Contract General Conditions.

(9) NOTICE TO PROCEED: A proceed order issued by the Contracting Officer after final execution of the Contract fixing the time within which the Contractor shall begin the prosecution of the Work.

(10) OWNER: The State of Alabama acting by and through the Armory Commission.

(11) BID: The written offer for the Work contemplated, when prepared and submitted by the Bidder in the required manner on the prescribed Bid Form, properly signed and guaranteed.

(12) SPECIAL CONDITIONS: Additional special or general requirements that are necessary and peculiar to the particular project and which are not included in the parts of the Armory Commission's standard General Conditions.

(13) SPECIFICATIONS: The general term comprising the Statutory and Procedural Documents, General Conditions of the Contract, the Detailed Standard and Project Specification requirements, together with all modifications thereof and all Addenda thereto.

(14) SUBCONTRACTOR: Any properly qualified individual, firm, association, or corporation undertaking the performance of any part of the Work under the terms of the Contract Documents by virtue of an agreement between himself and the Contractor with the written approval of the Contracting Officer.

(15) SURETY: The corporate body, licensed under the laws of Alabama, bound with and for the Contractor for the full and complete performance of the Contract and also for the payment of all claims recoverable under the Contract Bonds.

(16) THE PROJECT: The total construction designed by the Architect of which the Work performed under the Contract Documents may be the whole or a part.

(17) THE WORK: The Work includes all labor necessary to produce the construction required by the Contract Documents, and all materials and equipment incorporated or to be incorporated in such construction.

(18) USPFO: The United States Property & Fiscal Officer. The USPFO is the State of Alabama representative for the National Guard Bureau, Washington, D.C., an agency of the United States Department of Defense.

B. INTENT:

The intent of the Contract Documents is to include all labor, materials, water, fuel, tools, plants, utility, and transportation services, and all other incidental services and expenses necessary or required for proper execution and completion of the work.

C. CORRELATION:

(1) ORDER OF PRECEDENCE: Should any discrepancy arise between the various elements of the Contract Documents, precedence shall be given the same in the following order:

(a) The Contract Agreement
(b) The Detailed Specification Requirements
(c) Details appearing on the Drawings
(d) The Working Drawings

(2) WORDS AND TERMS: Words used in the documents will be given their usual and common meaning unless from the entire Contract it is clear that some other meaning was intended. Words describing material or work which have a well known technical meaning or trade meaning unless specifically defined in the Contract Documents, will be construed in accordance with such well known meaning recognized by architects, engineers, and the trades. Technical terms will be construed in a technical sense, and a specially widely adopted trade meaning afforded certain terminology will be taken into account in any interpretation containing such terminology.

(3) GENERAL AND SPECIAL CONDITIONS: Where both General and Special Conditions relate to the same thing, the Special will prevail; that is, the specific language will take precedence over the more general wording. However, where both the General and Special Conditions may be given reasonable effect, both are to be retained.

(4) PRINTING, TYPING, AND WRITING: When a printed portion of the Contract Documents cannot be reconciled with a typewritten portion, the latter will prevail. Various types of duplicating processes will be considered typewriting instead of printing. Also, if one is typewritten and the other written in longhand, the one written in longhand will govern. Likewise, written numbers will govern.

Written specifications will take precedence over drawings. If a correction is made in specifications or on a drawing and the original conflicting statement is not crossed out, then the revision, written in or drawn in, will be considered what was meant.

Obvious clerical or drafting errors or omissions revealed by perusal of the Contract Documents as a whole will be discounted in determining the intent of the parties, insofar as this may be accomplished without contravention of legal principles or public policy.

(5) DRAWINGS AND SPECIFICATIONS: The intent of the Specifications is to outline or indicate items of work on both, that cannot readily be shown on the Drawings and, further, to indicate types and qualities of materials and workmanship. Drawings and Specifications will be considered complimentary, and items of work mentioned or indicated on one and not on the other shall be included as if mentioned in both, except items definitely noted "Not in Contract" or marked "N.I.C."

(6) CONTRACTOR'S CHECK: Prior to the execution of the Work, the Contractor shall check the Drawings and Specifications and shall immediately report all errors, discrepancies, and/or omissions discovered therein by letter to the Architect with a copy to the Contracting Officer. All such errors, discrepancies, and/or omissions will be adjusted by the Architect and/or the Contracting Officer, who will notify the Contractor. Any adjustments made by the Contractor without prior approval will be at his own risk and the settlement of any complications arising from such adjustment will be at his own expense.

(7) EXPLANATIONS: Any doubt as to the meaning of the Specifications, or any obscurity as to the wording of them, will be explained by the Architect and all directions and explanations requisite or necessary to complete, explain or make definite any of the provisions of the Specifications and Drawings and given them due effect, will be given by the Architect in writing.

D. STREAMLINING:

(1) OMISSION OF WORDS AND PHRASES: The detailed Standard and Project Specifications are of abbreviated or "streamlined" type and include incomplete sentences in order to avoid cumbersome and confusing repetition of expression. Omissions of words or phrases such as "the Contractor shall," "in conformity therewith," "as noted," or "as indicated on the Drawings," "according to the Drawings," are intentional. Omitted words or phrases will be supplied by inference in the same manner as they are when a "note" occurs on the Drawings.

Wherever in the Specifications or upon the Drawings, APPROVED, AUTHORIZED, CONTEMPLATED, CONSIDERED NECESSARY, DEEMED NECESSARY, DESIGNATED, DIRECTED, GIVEN, ORDERED, PERMITTED, PRESCRIBED, REQUIRED, or words of like import are used, they shall be construed to mean and intend "by the Contracting Officer;" and, similarly, the words ACCEPTABLE, SATISFACTORY, or words of like import shall be construed to mean acceptable to or satisfactory "to the Contracting Officer," unless otherwise expressly stated or the Contract clearly indicates another meaning.

Words "furnish," "install," "perform," "provide," and "work" shall mean that the Contractor shall furnish, install, perform, provide and connect up complete in operative condition and use all materials, equipment, apparatus, and required appurtenances of the particular item to which it has reference.

(2) APPLICABLE PUBLICATIONS: Reference to standard specifications, associations, bureaus, organizations, or industries, and the like, shall mean the latest edition of such references adopted and published at date of Advertisement for Bids.

3. ADDITIONAL DETAIL DRAWINGS AND INSTRUCTIONS:

Further information and instructions may be issued by the Contracting Officer or prepared by the Architect and transmitted to the Contractor by the Contracting Officer or the Architect, during the progress of the Work by means of additional detail drawings or otherwise as deemed necessary to make more clear or specific the Drawings and Specifications in the Contract Documents, when and as required by the Work. All such drawings and instructions shall be consistent with the Contract Documents, true developments thereof, and reasonably inferable therefrom.

Any discrepancies found between the Drawings and Specifications and site conditions shall be immediately reported in writing to the Architect who will promptly correct such error or omission in writing. Any work done by the Contractor after his discovery of such discrepancies, errors, or omissions shall be done at his own risk.

In case of differences between small and large scale drawings, the large scale drawings shall govern.

Where on any of the drawings a portion of the Work is drawn out and the remainder is indicated in outline, the parts drawn out shall apply also to all other portions of the Work.

Where the word "similar" occurs on the Drawings, it shall be interpreted in its general sense and not as meaning identical, and all details shall be worked out in relation to their location and their connection with other parts of the Work.

If the Contractor considers that any work is required in a manner to make it impossible to produce first-class work, or should discrepancies appear among the Contract Documents, the Contractor shall request interpretation before proceeding with such work. If he fails to make such request, no excuse will thereafter be entertained for failure to carry out the work in a satisfactory manner.

4. COPIES FURNISHED CONTRACTOR:

Except as otherwise provided, all required copies of Drawings and Specifications reasonably necessary for the execution of the Work will be furnished to the Contractor by the Architect or Contracting Officer without charge. Other copies requested will be furnished at reproduction cost.

5. SHOP DRAWINGS:

The Contractor shall check the Contract Drawings for accuracy and verify with field measurements as necessary. He shall submit to the Architect, with his criticism and/or approval, all layouts, detail schedules, shop drawings, and setting or erection drawings as required by the Specifications or requested by the Contracting Officer for proper installation of materials, without causing delay in the Work. The Contractor shall check Subcontractors' shop drawings for accuracy and see that work contiguous with and having bearing on work indicated on shop drawings is accurately and distinctly illustrated. Shop drawings shall be dated, numbered consecutively, show working and erection dimensions and necessary details, including complete information for connecting to other work. Any work required by shop drawings that is fabricated by the Contractor prior to approval shall be at his own risk.

All drawings and schedules, accompanied by a letter of transmittal containing project number, number of drawings, titles, or other pertinent data, shall be submitted to the Architect in quintuplicate by the Contractor (with his stamp of approval thereon) sufficiently in advance of construction requirements to allow checking, correcting, resubmitting, and rechecking. A duplicate of said letter, only, shall be mailed simultaneously to the Contracting Officer. If shop drawings show variations from the requirements of the Contract Documents because of standard shop practice or other reasons, specific mention of such variations shall be made in the letter of submittal.

Satisfactory drawings will be so identified, dated, approved, and three copies or sets returned to the Contractor by the Architect. Should shop drawings be disapproved, three sets will be returned to the Contractor by the Architect indicating corrections and changes to be made.

Such corrections, changes, including design and artistic effect, shall be made by the Contractor and bound sets of shop drawing prints shall be submitted in quintuplicate to the Architect until final approval is obtained. No corrections or changes indicated on shop drawings will be considered as Extra Work.

The approval of shop drawings, schedules, and setting drawings will be general and, except in departures found to be in the interest of the Owner and so minor as not to involve a change in the Contract Price or performance time, shall not be construed (1) as permitting any departure from contract requirements; (2) as relieving the Contractor of the responsibility for any error in details, dimensions, or otherwise that may exist in shop drawings or schedules; (3) as approving departures from Drawings and Specifications or from additional details or instructions previously furnished by the Architect, unless he has in writing called attention to such deviations at the time of submission, and secured written approval.

6. PROJECT AND RECORD DOCUMENTS:

The Contractor shall keep on the site of the work in good order, at least one set of his Contract Drawings including shop drawings, Specifications, and all authorized Change Orders, and shall at all times give the Owner, Architect, and their authorized representatives access thereto.

The Contractor shall also keep in his office on the site of the work the two sets of Contract Drawings and Specifications furnished by the Owner, herein referred to as RECORD DRAWINGS, on which shall be recorded all work as built or installed, and such other information as is specified or required. He shall carefully draw and letter notes of explanation, in ink, on both sets of Record Drawings, or furnish two copies of detailed sketches as the Contracting Officer may require, as a fully dimensioned record of all work. The Record Drawings, supplemented by any detailed sketches deemed necessary, shall indicate the Work "AS BUILT". The Contractor will be required to prepare new drawings if the indications on the Record Drawings or the detailed sketches are illegible or otherwise unsatisfactory for future reference. Each record or correction made on such drawings will be initialed and dated by the Supervisor or Inspector.

7. OWNERSHIP OF DRAWINGS:

All original or duplicated Drawings and Specifications, and other data prepared by the Architect, and copies thereof prepared and furnished to the Contractor by the Architect are the property of the Armory Commission.

Upon completion of the Work all copies of Drawings and Specifications, with the exception of two sets retained by the Contractor, and two sets of RECORD DRAWINGS, shall be returned by the Contractor to the Architect. The Record Drawings will be delivered by the Architect to the Owner on Completion of the Work.

8. SAMPLES:

The Contractor shall, without undue delay, furnish and submit to the Architect any samples that require the Architect's approval, and also any samples that may be requested by the Contracting Officer, of any and all materials or equipment he proposes to use, and shall prepay all shipping charges on the samples. Samples shall be furnished sufficiently in advance to allow the Architect and/or Contracting Officer reasonable time for examination, investigation, or consideration, without delay to the Work.

The Contractor shall provide Subcontractors and his prospective manufacturers, material dealers or suppliers with complete information of pertinent contract requirements and all transactions therewith shall be through the Contractor.

No materials or equipment of which samples are required to be submitted for approval shall be used on the Work until such approval has been received, save only at the Contractor's risk and expense.

Each sample shall have a label indicating the material represented, its place of origin and the name of the producers, the Contractor, and the building or Work for which the material is intended. Where manufacturer's printed instructions for installations are required, duplicate copies of such directions shall be submitted with samples.

Samples of finished material shall be marked to indicate where the materials represented are required by the Drawings or Specifications.

A letter, submitting each shipment of samples shall be mailed by the Contractor to the Architect containing a list of the samples, the name of the building or Work for which the materials are intended, and the brands of materials and names of the manufacturers.

After a material has been approved by the Architect with the approval of the Contracting Officer, if required, no additional samples of that material will be considered and no change in brand or make will be permitted.

Approved samples of hardware, in good condition, may be suitably marked for identification and used in the Work.

The approval of any sample by the Architect or Contracting Officer will be only for the characteristics or for the uses named in such approval and shall not be construed in itself to change or modify any Contract requirements.

Failure of any materials to pass the specified tests will be sufficient cause for refusal to consider any further samples of the same brand or make of that material for use in the Work.

Test samples as the Architect or Contracting Officer may deem necessary, will be produced from the various materials delivered to the Contractor for use in the Work. If any of these test samples fail to meet the specification requirements, any previous approval will be withdrawn and such materials shall be subject to removal and replacement by the Contractor with materials or equipment meeting the specification requirements, the defective materials may be permitted to remain in place subject to proper credit or adjustment of the Contract Price as hereinafter set forth under DEDUCTIONS FOR UNCORRECTED WORK.

The costs of tests will be borne by the Owner except where laboratory tests as hereinafter specified are required by the specifications.

9. PROGRESS SCHEDULE AND CHARTS:

The Contractor shall within five days after date of commencement of work, prepare and submit to the Architect for approval, a practicable schedule showing the order in which the Contractor proposes to carry on the Work, the date he will start the several salient features, including procurement of material, plant, and equipment and the contemplated date of completion of same.

The schedule shall be in the form of a conventional Progress Chart of suitable scale to indicate appropriately the percentage of work scheduled for completion at any time. The Contractor shall enter on the chart his actual progress, preferably at the end of each week, but in any event at the end of each month, and deliver to the Architect two copies thereof and attach one to his monthly Application for Partial Payment.

If, in the opinion of the Architect or the Contracting Officer, the Contractor falls materially behind his progress schedule, the Contractor shall take such steps as may be necessary to improve his progress and the Architect or the Contracting Officer may require him to increase the number of shifts, and/or overtime operations, and/or the amount of construction plant, and to submit for approval such supplementary schedules in chart form as may be deemed necessary to demonstrate the manner in which the agreed rate of progress will be regained, all without additional cost to the Owner.

Failure of the Contractor to comply with the requirements of the Architect or the Contracting Officer as above set forth will be grounds for determination by the Architect or the Contracting Officer that the Contractor is not prosecuting the Work with such diligence as will insure completion within the Contract Time. Upon determination of unreasonable delay, the Owner may terminate the Contractor's right to proceed with the Work, or any separable part thereof.

10. MATERIALS, EQUIPMENT, AND EMPLOYEES:

Unless otherwise stipulated, the Contractor shall furnish all material, equipment, tools, labor, water, light, power, transportation, other services or facilities and incidentals for the proper execution and completion of the Work. Unless otherwise stipulated, all materials and equipment incorporated in the Work shall be new.

All labor shall be performed in the best and most workmanlike manner by persons skilled in their respective assignments or trades. Workmen whose work is unsatisfactory to the Architect or the Contracting Officer, or who are considered unfit or unskilled, or otherwise objectionable, shall be dismissed upon notice from the Architect or Contracting Officer.

11. EQUIPMENT AND MATERIAL DEVIATIONS:

Whenever any material or piece of equipment is identified on the plans or in the specifications by reference to manufacturer's names, model numbers, etc., it is intended to establish a required standard of design and quality, and is not intended to limit competition. It shall be expressly understood that the phrase "or approved equal" is hereby inserted following the naming of manufacturers for any material or equipment, whether such phrase occurs in the specifications, or not.

When the specifications and/or drawings indicate only one or two manufacturers' names for material or equipment to be used, the bidder may submit his bid based on material or equipment of manufacturers not named but considered by the bidder to be equal to the standard of design and quality as specified; however, such substitutions must be approved by the Architect. If the bidder elects to bid on a substitution without securing written approval of the Architect prior to receipt of bids, then it will be understood that proof of compliance with specified requirements is the direct responsibility of the bidder and no such material or equipment may be purchased or installed without written approval by the Architect.

When the specifications and/or drawings indicate three or more manufacturers' names for material or equipment to be used, the bids shall be based upon the equipment and material so named, unless the bidder desires to bid on an "approved equal". In case the bidder desires to substitute an "equal" he must secure written approval by the Architect of qualification to bid prior to date for receiving bids. If no request to substitute an "approved equal" is made by the bidder, and approved by the Architect, then it will be expressly understood that all such material and equipment so named or described in the specifications and on the drawings will be furnished in full accordance with the Contract Documents.

12. ROYALTIES; PATENTS; AND COPYRIGHTS:

The Contractor shall pay all royalties and license fees. The Contractor shall hold and save the Owner and his agents and employees harmless from liability of any nature or kind, including cost and expenses, for or on account of any patented or unpatented invention, process, article, or appliance manufactured or used in the performance of the Contract, including its use by the Owner.

If the Contractor has information that any process, article or item specified or delineated by the Architect is an infringement of a patent, or a copyright, he shall promptly give such information to the Architect.

13. SURVEYS, PERMITS, LAWS, AND REGULATIONS:

The Contractor shall provide competent engineering services to execute the Work in accordance with contract requirements. He shall verify the figures given for the contours, approaches and locations shown on the Drawings before undertaking any construction work and be responsible for the accuracy of the finished work. Without extra cost to Owner, he shall engage a licensed surveyor if necessary to verify boundary lines, keep within property lines, and shall be responsible for encroachments on rights or property of public or surrounding property Owners.

The Contractor shall establish all base lines for the location of the principal components of the Work and make all detail surveys necessary for construction, including slope stakes, batter boards and other working points, lines and elevations.

If the Contractor finds any errors or discrepancies, or that any previously established references have been destroyed or misplaced, he shall promptly notify the Architect.

The Contractor shall obtain and pay for all licenses and permits and shall pay all fees and charges for connection to outside service and the use of property, other than the site of the Work, required for the execution and completion of the Work.

The Contractor shall give all notices and comply with all laws, ordinances, rules, regulations, and building code requirements applicable to or bearing on the conduct of the Work unless in conflict with Contract requirements. If the Contractor ascertains at any time that any requirement of the Contract is at variance with applicable laws, ordinances, regulations, or building code requirements, he shall promptly notify the Architect, and any necessary adjustment of the Contract will be made as hereinafter specified under CHANGES IN THE WORK.

The Contractor shall pay all applicable Federal, State and local taxes and assessments on the real property of the site of the Work.

Wherever the law of the place of building requires a special sales tax, consumer, use, occupation, or other tax, the Contractor shall pay such tax.

14. PROTECTION OF WORK AND PROPERTY:

The Contractor shall at all times adequately maintain, guard and protect his own work from damage, and safely guard and protect the Owner's property from injury or loss arising in connection with this Contract. He shall make good any such damage, injury or loss, except such as may be directly due to errors in the Contract Documents or caused by agents or employees of the Owner.

He shall adequately protect adjacent property as provided by law and Contract Documents.

Any damage to existing structures, or the interruption of a utility service shall be repaired or restored promptly by and at the expense of the Contractor.

The Contractor shall protect all existing vegetation such as trees, shrubs, and grass on or adjacent to the site which are not required to be removed or do not unreasonable interfere with construction, as may be determined by the Architect or Contracting Officer, and be responsible for all unauthorized cutting or damaging of trees and shrubs, including damage due to careless operation of equipment, stockpiling of materials, on grass areas by equipment.

Care shall be taken by the Contractor in felling trees that are to be removed to avoid any unnecessary damage to vegetation or other trees that are to remain in place. Any limbs or branches unavoidably broken during such operations shall be trimmed with a clean cut and painted with an approved tree priming compound. The Contractor may be required to replace or restore at his own expense all vegetation not protected and preserved, as above required, that may be destroyed or damaged.

The Contractor shall provide and maintain all passageways, guard fences, lights, and other facilities required for protection by state or municipal laws and regulations or local conditions.

The Contractor shall take all necessary precautions for the safety of employees on the Work and shall comply with all applicable provisions of federal, state, and municipal safety laws and building codes to prevent accidents or injury to persons on or about or adjacent to the premises where the Work is being performed. He shall erect and properly maintain at all times, as required by conditions and progress of the Work, all necessary safeguards for the protection of workmen and the public, and shall post danger signs warning against the hazards created by such features of construction as protruding nails, hoists, well holes, elevator hatchways, scaffolding, window openings, stairways, and falling materials.

Machinery, equipment and all hazards shall be guarded or eliminated in accordance with the latest edition of the Manual of Accident Prevention in Construction of the AGC to the extent that such provisions are not in contravention of applicable laws.

In case of an emergency which threatens loss or injury of property, and/or safety of life, the Contractor may act, without previous or special instructions from the Architect, or the Contracting Officer, at his discretion; and shall so act, without appeal, if so instructed or authorized by the Architect or the Contracting Officer.

Any compensation claimed by the Contractor as Extra Work on account of emergency work, together with substantiating documents in regard to expense, shall be submitted through the Architect to the Contracting Officer who will determine the amount of compensation.

15. CLIMATIC CONDITIONS:

When so ordered by the Architect or Contracting Officer, the Contractor shall suspend any work that may be subject to damage by climatic conditions.

16. TEMPORARY UTILITIES:

Unless otherwise agreed to by the Owner in writing, the Contractor shall provide all necessary utility services, at his expense, until the job is complete and accepted by the Owner. All utilities services shall include, but not be limited to, the following: electricity; gas; water; sewer; telecommunications; waste (dumpster) disposal, etc.

The Contractor shall provide all utility services as necessary to install and/or test all work and materials, and further to protect and maintain all work and materials against injury or damage from heat or cold and from humidity/dampness. The Contractor shall continue to provide these services, at his expense, until completion and final acceptance by the Owner of all work in the Contract. The Contractor may be relieved of utilities expenses, in whole or part, should the building(s) be fully occupied by the Owner prior to such final acceptance of the work. The Contractor may petition in writing for the Owner to consider this relief of utilities expenses (either partially or wholly) due to this full occupation of the building(s) by the Owner. The Owner must provide a written and signed agreement in order to relieve Contractor of the utilities expenses. Any such date of relief shall be as established in this written agreement.

In the absence of any such written agreement by the Owner, the Contractor shall continue to provide heat and conditioned air as necessary to protect all work and materials against injury from dampness and heat/cold until final acceptance of all work in the Contract as indicated herein.

A. HEATING: During cold weather or the winter months, the Contractor shall provide heat and weather protection as follows:

(1) At all times during the placing, setting, and curing period of concrete, sufficient heat to insure the heating of spaces to not less than 50° F. or in accordance with the manufacturer's recommendations.

(2) From the beginning of the application of plaster and during the setting and curing period, sufficient heat to produce a temperature of not less than 50° F. or in accordance with the manufacturer's recommendations.

(3) For a period of ten days previous to the placing of interior wood finish work and throughout the placing of wood finish and other interior finishing, varnishing, painting, etc., and until final acceptance of the Work, sufficient heat to produce a temperature of not less than 70° F. or in accordance with the manufacturer's recommendations.

(4) Provide temporary closures for windows, doors, and all temporary openings and take every reasonable precaution to prevent the escape of warm air from or entrance of cold air into the building. Except as elsewhere called for, the temperature required in the unoccupied spaces will be from 45° F. to 65° F.

B. VENTILATION and AIR CONDITIONING: During hot weather or the summer months, the Contractor shall provide ventilation and/or air conditioning as required in order to maintain the temperature of the interior of the building(s) between 70° F. and 80° F. The Contractor shall also maintain the humidity level of the interior of the building(s) within the ranges specified in the Contract Documents.

C. In all cases, Contractor shall be responsible to maintain the appropriate temperature range and humidity levels as is recommended by the manufacturer of all the various building materials, furnishings, equipment, components, systems, etc. to prevent any damage due to heat or cold or humidity.

D. Unless otherwise agreed to by the Owner in writing, the Contractor shall continue to provide these utility services, at his expense, until the job is complete and accepted by the Owner.

17. INSPECTION OF THE WORK:

The Architect, the Contracting Officer, any Federal or State agency having jurisdiction, and their representatives shall have access at all times to the Work for inspection whenever it is in preparation or progress, and the Contractor shall provide proper facilities for such access and inspection.

All materials, workmanship, processes of manufacture, and methods of construction, if not otherwise stipulated in the Specifications, shall be subject to inspection, examination, and test by the Architect (or his

duly authorized representative) at any and all places where such manufacture and/or construction are being carried on. The Architect shall have the right to reject defective material and workmanship or require its correction. Rejected workmanship shall be satisfactorily corrected, and rejected material shall be satisfactorily replaced with proper material without charge therefor, and the Contractor shall promptly segregate and remove the rejected material from the premises.

The Contracting Officer will appoint or assign architectural and engineering Inspectors, with designated duties and restricted authority, to inspect the Work as he may direct, or to make special inspections requested in advance by the Contractor, and to report to him progress of the Work, and manner of procedure, quality of the material and workmanship, and compliance with the Contract Documents. Inspectors shall have the authority to give directions for the safety and convenience of the public, and concerning the conduct of the Work; to advise the Contractor to avoid his making errors and to expedite his correction of deviations in the Work, to reject materials, workmanship, or equipment clearly defective or otherwise not in accordance with the Drawings and Specifications; but neither the presence nor absence of such Inspectors shall relieve the Contractor from any contract requirement.

Neither the Inspectors, nor the Architect, will be authorized to revoke, alter, relax, or waive, any requirements of the Contract Documents, to finally approve or accept any portion of the Work or to issue instructions contrary to the Drawings and Specifications; nor shall they supervise and direct work for the Contractor, nor unreasonably interfere with the Contractor's operations beyond the extent necessary to make certain that the Work is being carried out according to the contract requirements.

Any advice which they may give the Contractor shall not be construed as binding the Owner or the Contracting Officer in any way, nor as releasing the Contractor from any of the contract requirements.

If the Contractor considers any work demanded of him to be outside the contract requirements, or any record or ruling of the Architect or an Inspector to be unfair, he may immediately, upon such work being demanded or ruling made, request written instructions from the Architect, or Inspector, or within ten days file an appeal with the Contracting Officer, stating clearly and in detail the basis of his objections. However, pending the Contracting Officer's decision on such appeal, no work shall be done in disregard of the rulings of the Architect or Inspector or his instructions on items of work affected by such appeal.

The Contractor shall furnish promptly, without extra compensation, all reasonable facilities, labor, and material necessary for safe and convenient access, inspection, and tests that may be required by the Contracting Officer or the USPFO. All inspections and tests will be performed in such a manner as not to cause unnecessary delay of the work. Special, full size, and performance tests shall be as described in Sections of the Specifications. The Contractor shall be charged any extra cost of inspection incurred by the Owner on account of material and workmanship not being ready at time of inspection set by the Contractor.

Should it be considered necessary or advisable by the Owner, or by the representatives of the Chief, National Guard Bureau, at any time before final acceptance of the entire work to make an examination of work already completed by uncovering, or removing or tearing out same, the Contractor shall, on request, promptly furnish all necessary facilities, labor, and materials. If such work is found to be defective in any material respect, due to the fault of the Contractor or his subcontractors, he shall defray all expense of such examination and of satisfactory reconstruction. If, however, such work is found to meet the requirements of the Contract Documents, work of examination and replacement will be considered and compensated for as Extra Work ordered by the Architect or Contracting Officer and, in addition, if completion of the Work has been delayed thereby, an extension of time will be granted for such delay as estimated by the Architect or Contracting Officer. Federal funding support of the cost for examination and replacement of satisfactorily completed work that requires removal or that is damaged due to inspection requirements is subject to prior approval by the Chief, National Guard Bureau, or his duly authorized representative.

When the Architect considers the work as nearing completion, or substantially completed, after being notified by the Contractor that the Work is completed, the Architect and the Contracting Officer or his representatives, duly authorized in writing, will inspect all the work included in the Contract Documents. If it is found that the Work has not been satisfactorily completed, the Architect will notify the Contractor, in writing, as to the work to be done or the particular defects to be remedied to place the work in condition satisfactory for acceptance. After the work has been satisfactorily completed, the Architect and the Contracting Officer will make the final inspection or inspections and notify the Contractor in writing when the Work has been finally accepted.

18. SUPERINTENDENCE AND SUPERVISION:

The Contractor shall give his personal superintendence of the Work, using his best skill and personal attention, or have a qualified superintendent, and any necessary assistants acceptable to the Contracting Officer, on the Work at all times during progress, and with full authority to act in his behalf. The Contractor shall not remove a superintendent from the Work who is satisfactory to both him and the Architect, except with the Architect's consent, unless he ceases to be in his employ.

All instructions given the superintendent in the Contractor's absence by the Architect or the Contracting Officer or his representative shall be considered as given the Contractor. In general, the more important verbal instructions will be confirmed in writing to the Contractor; and upon written request of the Contractor, any other instructions will be confirmed in writing.

The Contractor shall carefully study and compare all Drawings, Specifications, other instructions and related data, and at once report in writing to the Architect, with a copy to the Owner, any inconsistency, discrepancy, error, or omission he may discover, for adjustment by the Architect. However, he shall not be liable to the Owner for any damage resulting from any errors or deficiencies in the Contract Documents, except that adjustments made without prior approval will be at his own risk.

19. CHANGES IN THE WORK:

The Owner may at any time make changes in the Work by changes in the Drawings and Specifications of the Contract and within the general scope thereof. Changes will be in the form of a Contract Change Order based upon a written request of the Owner and a written proposal of the Contractor. In making any change, the charge or credit for altering, adding to or deducting from the Work shall be determined by one of the following methods selected by the Owner:

A. By mutually agreed price or prices which will be added to or deducted from the Contract Price. Additions to the contract price shall include the Contractor's overhead and profit but shall not exceed 15 percent. Where subcontract work is involved, the total mark-up for the Contractor and subcontractors shall not exceed 25%. This percentage allowance for overhead and profit shall include the cost of superintendent, timekeeper, clerks, watchmen, use of small tools, incidental job burdens, and general office expenses. There will be no additional or separate charges for these items. No allowance for overhead and profit shall be figured on any change which involves a net credit to the Owner.

B. By estimating the number of unit quantities of each part of the Work which is changed and then multiplying the estimated number of such unit quantities by the applicable unit prices, if any, set forth in the Contract, or other mutually agreed unit prices. The percentage and criteria for overhead and profit shall be as detailed in paragraph A above. There will be no additional or separate charges allowed for superintendent, timekeeper, clerks, watchmen, use of small tools, incidental job burdens, and general office expenses.

C. By ordering the Contractor to proceed with the Work on a cost-plus-percentage-of-the-cost basis and to keep and present in such form as the Contracting Officer will approve, duplicate itemized statements of the cost of the change together with all vouchers therefor, detailed as to the following items:

(1) Name, classification, date, daily hours, total hours, rate, and extensions for such laborers and pro-rata charges for foreman.

(2) Designation, dates, daily hours, total hours, rental rates, and extensions for each piece of equipment or power tool actually used.

(3) Quantity of each material item actually used and extension.

(4) Transportation on materials used.

(5) Power and all items of cost such as cost of property damage, public liability and workmen's compensation insurance; also social security, old age and unemployment insurance.

(6) The percentage allowance for the Contractor's overhead and profit shall not exceed a total of 15 percent of the net cost of above items (1), (2), (3), (4) and (5). The percentage allowance for overhead

shall include the cost of bonds, superintendent, timekeeper, clerks, watchmen, use of small tools, incidental job burdens, general office expenses, and insurance other than items listed above in paragraph C(5).

(7) The credits to the Owner for deductive changes shall be the net cost to the Contractor, excluding project overhead and profit.

The Contractor shall furnish to the Owner an itemized breakdown of the quantities and prices to be used in estimating the value of any change that might be ordered.

Federal funding support of any change or extra is subject to prior approval by the Chief, National Guard Bureau, or his/her duly authorized representative.

20. CLAIMS FOR EXTRA COST OR EXTRA WORK:

If the Contractor claims that any instructions, by drawings or otherwise, are not in accordance with the Contract Documents, and involve extra cost under the Contract, he shall give the Architect and the Contracting Officer written notice there of within ten (10) days after receipt of such instructions, and in any event before proceeding to execute the work, and the procedure shall then be as above under 19, CHANGES IN THE WORK. Otherwise no such claim will be considered.

Federal funding support of any change or extra is subject to prior approval by the Chief, National Guard Bureau, or his/her duly authorized representative.

21. DEDUCTIONS FOR UNCORRECTED WORK:

If the Owner deems it expedient to correct work injured or installed at variance with the Contract requirements, the Owner may, if he finds it to be in his interest, allow part or all of such work to remain in place, provided an equitable deduction from the Contract Price is offered by the Contractor and approved by the Contracting Officer.

22. DELAYS; EXTENSION OF TIME:

Delays: A delay beyond the Contractor's control at any time in the progress of Work by an act or omission of the Owner or the Architect, or the Contracting Officer or by any other Contractor employed by the Owner, or by strikes, fires, abnormal floods, tornadoes, or other cataclysmic phenomenon of nature, may entitle the Contractor to an extension of time in which to complete the Work as determined by the Contracting Officer provided, however, that the Contractor shall immediately give written notice to the Architect of the cause of such delay.

No such extension shall be made for delays due to rain, wind, flood, or other natural phenomenon of normal intensity for the locality, or for delay occurring more than seven (7) days before written claim therefor is submitted by the Contractor.

Extension of Time: In the event any material changes, alterations or additions are made as herein specified which in the opinion of the Contracting Officer, will require additional time for the execution of any work under the Contract, then, in that case, the time of completion of the Work will be extended by such a period of time as may be fixed by the Contracting Officer, and his decision shall be final and binding upon the Owner and the Contractor, provided that in such case the Contractor within seven (7) days after being notified in writing of such changes, alterations or additions shall request in writing an extension of time, but no extensions of time shall be given for any minor changes, alterations or additions. The Contractor shall not be entitled to any reparation or compensation on account of such additional time or extensions of time required for the execution of the Work. Only claims for compensation that are approved in accordance with the procedures outlined as above in Paragraph 19, CHANGES IN THE WORK and in Paragraph 20, CLAIMS FOR EXTRA COST OR EXTRA WORK and are also approved in writing by the Owner shall be considered. Otherwise no such claims will be considered.

23. CORRECTION OF WORK BEFORE FINAL PAYMENT:

Any defective work, whether the result of poor workmanship, the use of defective materials, damage through carelessness of the Contractor or his employees, or any other cause, shall be removed from the premises within ten (10) days after written notice is given by the Architect, and promptly replaced and re-

executed by the Contractor in accordance with the contract requirements and without expense to the Owner. The Contractor shall also bear the expense of making good all work of the Owner or his other contractors destroyed or damaged by such removal and replacement.

24. CORRECTION OF WORK AFTER FINAL PAYMENT:

Verification and approval of the Final Application for Payment and the making of the Final Payment by the Owner shall not relieve the Contractor of responsibility for faulty materials or workmanship. The Owner or the User shall promptly give notice of observed defects due to faulty materials or workmanship, and any damage to other work resulting therefrom, and in accordance with the terms of any special guarantees provided by the Contract, and the Contractor shall promptly replace any such defects discovered within one year from the date of written acceptance of the Work or Final Payment therefor, whichever is prior. All questions arising hereunder, notwithstanding Final Payment, shall be decided by the Contracting Officer.

25. OWNER'S RIGHT TO CORRECT DEFICIENCIES:

Upon failure or neglect by the Contractor to properly prosecute, or to perform the Work in accordance with the Contract Documents, including any requirements with respect to the Progress Schedule and/or Charts, and after ten (10) days' written notice to the Contractor by the Contracting Officer, the Owner may, without prejudice to any other remedy he may have, correct such deficiencies and may deduct the actual cost thereof to the Owner from payment then or thereafter due to the Contractor, provided, however, that the Contracting Officer shall approve both such action and the amount charged the Contractor.

26. OWNER'S RIGHT TO TERMINATE CONTRACT:

If the contractor refuses or fails to prosecute the work, or any separate part thereof, with such diligence as will insure its completion within the time specified in this contract, or any extension thereof, or fails to complete said work within such time, or if the Contractor should be adjudged a bankrupt, or if he should make a general assignment for the benefit of his creditors, or if a receiver should be appointed on account of his insolvency, or if he should refuse or should fail, except in cases for which extension of time is provided, to supply enough properly skilled workmen or proper materials, or if he should fail to make prompt payment to Subcontractors for material or labor, or disregard laws, ordinances, or the instructions of the Contracting Officer or the Architect, or otherwise be guilty of a substantial violation of any provision of the Contract, then the Owner, upon the certificate of the Contracting Officer that sufficient cause exists to justify such action, may, without prejudice to any other right or remedy and after giving the Contractor, and his Surety, ten (10) days' written notice, terminate the employment of the Contractor and take possession of the promises and of all materials, tools, equipment, and appliances thereon and finish the Work by whatever method he may deem expedient. In such cases, the Contractor shall not be entitled to receive any further payment until the Work is finished. If the unpaid balance of the Contract Price shall exceed the expense of finishing the work, including compensation for additional architectural, engineering, managerial, and administrative services, such excess shall be paid to the Contractor. If such expense shall exceed such unpaid balance, the Contractor shall pay the difference to the Owner. The expense incurred by the Owner as herein provided, and the damage incurred though the Contractor's default, shall be certified by the Contracting Officer.

27. CONTRACTOR'S RIGHT TO STOP WORK OR TERMINATE THE CONTRACT:

If the Work should be stopped under an order of any court, or other public authority, for a period of ninety (90) days, through no act or fault of the Contractor or of anyone employed by him, then the Contractor may, upon fourteen (14) days' written notice to the Owner and the Contracting Officer, stop work or terminate this Contract at the Owner(s) will reimburse the Contractor for all work properly executed and any proven loss sustained upon any plant or materials and any other proper item of damage certified by the Contracting Officer.

28. APPLICATIONS FOR PARTIAL AND FINAL PAYMENTS:

The Contractor shall, within ten (10) days after the Notice to Proceed, submit to the Architect on the application for payment form approved or furnished by the Contracting Officer, a complete breakdown or schedule of values of the Contract price showing the value assigned to each of the various parts of the work, including an allowance for overhead and profit, aggregating the total contract price so divided as to facilitate payments to subcontractors. Upon approval, this breakdown of the contract price, unless later found to be in error, shall be used as a basis for all applications for payment.

Unless otherwise provided in the Special Conditions or the Contract Agreement, the Contractor may make application for partial payment once each calendar month based on an approved estimate of work completed. The application shall be submitted through and certified by the Architect. The Owner will make partial payments to the Contractor as soon as practicable after receipt of the certified application for payment.

An application for partial payment may include the Contractor's cost of materials not yet incorporated in the work but delivered and suitably stored on the site.

In making partial payments there shall be retained not more than five (5) percent of the estimated amount of work done and the value of materials stored on the site, and after 50 percent completion has been accomplished, no further retainage will be withheld. The retainage above set out shall be held until final completion and acceptance of all work covered by the contract.

If the Contractor's claim to amounts payable under the contract has been assigned under the Assignment of Claims Act of 1940, as amended (41 U.S.C. 15), a release may also be required of the assignee at the option of the Contracting Officer or USPFO of the State. The retainment on partial payments of Federal funds shall be determined by the USPFO of the State in conformance with the Defense Acquisition Regulations (DAR).

The Contractor, immediately after being notified by the Contracting Officer that all other requirements of the Contract have been completed, shall give notice of said completion by an advertisement for a period of four (4) successive weeks in some newspaper of general circulation published within the county where the work was performed. Proof of publication of said notice in duplicate shall be furnished by the Contractor to the Architect by affidavit of the publisher and a printed copy of the notice published in duplicate. If no newspaper is published in the county where the work was done, the notice may be given by posting at the Court House for thirty (30) days and proof of same made by the Probate Judge or Sheriff and the Contractor. Final payment shall be due as noted by the Contracting Officer's verification of the Final Application for Payment.

29. VERIFICATION, CERTIFICATION, AND APPROVALS FOR PAYMENT:

When the Contractor has made application for payment as above, the Contracting Officer shall, not later than the date when each payment falls due, verify the application for Payment to the Contractor for such amount as he decides to be properly due, or state in writing to the Contractor his reasons for withholding verification in whole or in part, and place the application in line for payment.

No such verification nor payment made to the Contractor, nor partial or entire use or occupancy of the work by the Owner, shall be an acceptance of any work or materials not in accordance with the Contract.

All material and work covered by partial payments made shall thereupon become the sole property of the Owner, but this provision shall not be construed as relieving the Contractor from the sole responsibility for the care and protection of material and work upon which payments have been made or the restoration of any damaged work or as a waiver of the right of the Owner to require the fulfillment of all the terms of the Contract.

30. PAYMENTS WITHHELD:

The Owner may withhold payment of the whole or any part of a verified or approved Application for Payment to such an extent as may be necessary to protect himself from loss on account of any of the following causes discovered subsequent to its verification or approvals:

A. Defective work.

B. Evidence indicating probable filing of claims by other parties against the Contractor.

C. Failure of the Contractor to promptly make payments to subcontractors, or for materials, labor, equipment and supplies.

D. Damage to another contractor under a separate Contract with the Owner.

When the above grounds are removed, applications for payments will then be verified and/or approved for amounts not previously verified and approved because of them.

31. CONTRACTOR AND SUBCONTRACTORS INSURANCE:

The Contractor shall not commence work under the Contract until he has obtained all insurance required thereunder from an insurance company authorized to do business in Alabama, and shall have filed the certificate of insurance showing type of coverage and correlation between the insurance furnished and that required or the certified copy of the insurance policy with the Contracting Officer through the Architect; nor shall the Contractor allow any subcontractor to commence work on his subcontract until all similar insurance has been so obtained and filed. Each insurance policy shall contain a clause that it shall not be cancelled by the insurance company without thirty (30) days' written notice to the Owner of intention to cancel. The amounts of such insurance shall not be less than the following:

A.	Workmen's Compensation and Employer's Liability:	$ Statutory
B.	Public Liability, Bodily Injury and Property Damage:	
	Injury or death of one person:	$ 50,000
	Injury or death to more than one person in a single occurrence:	$200,000
	Property Damage:	$ 50,000
C.	Automobile and Truck Liability, Bodily Injury and Property Damage:	
	Injury or death to one person:	$ 50,000
	Injury or death to more than one person in a single occurrence:	$200,000
	Property Damage:	$ 50,000
D.	Indemnity:	SEE BELOW

The Contractor shall assume all liability for and shall indemnify and save harmless, the State, Owners, Architect, and employees of the Armory Commission, from all damages and liability for injury to any person or persons, and injury to or destruction of property, including the loss of use thereof, by reason of an accident or occurrence arising from operations under the Contract, whether such operations be by himself or by a Subcontractor or by any one directly or indirectly employed by either of them, occurring on or about the premises, or the ways and means immediately adjacent, during the term of the contract, or any extension thereof, and shall also assume the liability for injury and/or damages to adjacent or neighboring property by reason of work done under the Contract.

The Contractor shall take out and maintain during the life of the Contract, insurance covering his liability under the above save harmless provision, and shall show evidence of coverage on the certificate of coverage previously noted.

The obligations of the Contractor under this paragraph 31-D shall not extend to the liability of the Architect, his agents or employees arising out of (1) the preparation or approval of maps, drawings, opinions, reports, surveys, Change Orders, designs or specifications, or (2) the giving of or the failure to give directions or instructions by the Architect, his agents or employees provided such giving or failure to give is the primary cause of the injury or damage.

32. OWNER'S FIRE INSURANCE (NOT USED)

33. FIRE INSURANCE, EXTENDED COVERAGE, VANDALISM AND MALICIOUS MISCHIEF:

Unless otherwise provided in the Modified General or Special Conditions, the Contractor shall, at his own expense, insure the Work included in the Contract against loss or damage by fire and against loss or damage covered by the standard extended coverage endorsement, with an insurance company or companies qualified to do business in Alabama and acceptable to the Owner, the amount of insurance at all times to be at least equal to the amount paid on account of work or materials incorporated in the Work and plus the value of work or materials furnished or delivered but not yet paid for by the Owner. The policies shall be in the names

of the Owners and the Contractor and "all Subcontractors" as their interests appear, and certificates of the insurance company as to the amount and type of coverage, terms of policies, etc., shall be delivered to the Contracting Officer through the Architect before partial payments are made.

When changes in scope of the work by written Change Order or Change Orders/Supplemental Agreements aggregate an amount equal to 15% of the total contract, including the Change Orders/Supplemental Agreements, the insurance coverage included under this heading shall be increased accordingly. Proof of coverage shall be established by endorsement to the original policy or by reissue of the original policy to include the added coverage, or in accordance with any other acceptable policy of the insuring company for increasing the coverage.

34. CONTRACT BONDS:

In order to insure the faithful performance of each and every condition, stipulation, and requirement of the Contract, and to indemnify and save harmless the Owner from any and all damages, either directly or indirectly (arising out of any failure to perform same), the successful Bidder to whom the Contract is awarded shall, within ten (10) days from the date of the award, unless otherwise stipulated in the Modified General Conditions, furnish at his own expense and file with the Owner an acceptable Surety Bond in an amount equal to one hundred (100) percent of the contract bid price of the Contract as awarded. Said Bond shall be made on the approved bond form, shall be furnished by a reputable surety company authorized to do business in the State of Alabama, shall be countersigned by an authorized agent resident in the State who is qualified for the execution of such instruments, and shall have attached thereto power of attorney of the signing official. In case of default on the part of the Contractor, all expenses incident to ascertaining and collecting losses suffered by the Owner under the Bond, including architectural, engineering, administrative, and legal services, shall lie against the Contract Bond for Performance of the Work.

In addition thereto, the successful Bidder to whom the Contract is awarded shall, within ten (10) days, unless otherwise stipulated in the General Conditions, furnish at his expense and file with the Owner an acceptable surety bond for Payment of Labor, materials, equipment and supplies, payable to the Owner in an amount equal to fifty (50) percent of the Contract Price, with the obligation that the Contractor shall promptly make payment to all persons furnishing him or them with labor, materials, or supplies for, or in the prosecution of the Work, including the payment of reasonable attorneys fees incurred by successful claimants or plaintiffs in suits on said bond. The date of neither bond shall be earlier than the date of the Contract Agreement.

If any surety upon any bond furnished in connection with this contract becomes unacceptable to the State, or if any such surety shall fail to furnish reports as to his financial condition from time to time as requested by the State, the Contractor shall promptly furnish such additional security as may be required from time to time to protect the interests of the State or of persons supplying labor or materials in the prosecution of the work contemplated by the contract.

Bonds shall remain in force during the entire guarantee period stipulated in the Contract.

35. DAMAGES:

Should either party of the Contract suffer damages because of any wrongful act or neglect of the other party or of anyone employed by him, claim shall be made in writing to the other party within a reasonable time of the first observance of such damage, and not later than the date of the Application for Final Payment, except as expressly stipulated otherwise in the case of faulty work or materials.

36. LIENS:

The Owner may request a complete release of all liens and if this is done, neither the Final Payment nor any part of the retained percentage shall become due until the Contractor shall deliver to the Owner a complete release of all liens arising out of the Contract, and, an affidavit that so far as he has knowledge or information the releases include all the labor and material for which a lien could be filed; but the Contractor may, if any Subcontractor refuses to furnish a release or receipt in full, furnish a bond satisfactory to the Owner, to indemnify him against any lien. If any lien remains unsatisfied after all payments are made, the Contractor shall refund to the Owner all moneys that the latter may be compelled to pay in discharging such a lien, including all costs and a reasonable attorney's fee.

37. ASSIGNMENT:

The Contractor shall not assign the Contract or sublet it as a whole without the written consent of the Owner, nor shall the Contractor assign any moneys due or to become due to him hereunder without the previous written consent of the Owner.

38. MUTUAL RESPONSIBILITY OF CONTRACTORS:

If the Contractor or any of his Subcontractors cause any loss or damage to any separate contractor with a prior, concurrent, or subsequent contract on the Work or on the site, or any undue delay to such separate contractor on the Work or on the site, and if such contractor makes claim against the Owner, on account of any loss so sustained, the Owner shall notify the Contractor who shall indemnify and save harmless the Owner against any expenses arising therefrom.

39. SEPARATE CONTRACTS:

The Owner may award other contracts for additional new construction, buildings or equipment, or for reconstruction, alteration, equipment, and improvement of existing buildings on the site, and the Contractor shall fully cooperate in the storage of materials and the detailed execution of work, coordinate and integrate his operations with such other contractors, and carefully fit his own work to that provided under other contracts, as he may be directed by the Contracting Officer. The Contractor shall not commit or permit any act which will interfere with the performance of work by any other contractor.

The Contractor, including his Subcontractors, shall keep himself informed of the progress and the detailed work of other contractors and shall notify the Contracting Officer immediately of lack of progress or defective workmanship on the part of other contractors, where such delay or such defective workmanship will interfere with his own operations of the work.

40. SUBCONTRACTS:

Concurrent with the execution of the Contract by the Contractor he shall submit in writing in five (5) counterparts to the Architect for approval by the Architect and the Contracting Officer the names of the Subcontractors proposed for the work. Subcontractors that have been so approved may not be changed thereafter except at the request of or with the approval of the Contracting Officer.

The Contractor shall not employ any subcontractor to whom the Owner or Contracting Officer may have any objection, but he will not be required to employ any subcontractor against whom he himself has a reasonable objection.

The Contractor shall be as fully responsible to the Owner for the acts and omissions of Subcontractors, and of persons employed by them, as he is for the acts and omissions of persons directly employed by him.

Nothing contained in the Contract Documents shall be construed as creating any contractual relationship between any Subcontractor and the Owner.

41. RELATIONS OF CONTRACTOR AND SUBCONTRACTORS:

The Contractor shall cause appropriate provisions to be inserted in all Subcontracts relative to the Work, to bind Subcontractors to the Contractor by the terms of the Contract Documents insofar as applicable to the work of Subcontractors, and to give the Contractor the same power as regards terminating any provisions of the Contract Documents.

The Articles, Divisions, Sections, or Paragraphs of the Specifications are not intended to control the Contractor in dividing the work among Subcontractors or to limit the work performed by any trade.

The Contractor shall be responsible for the coordination of Subcontractors, of the trades, and material men engaged upon his work.

The Contractor shall, without additional expense to the Owner, utilize the services of specialty subcontractors on those parts of the work which are specified to be performed by specialty subcontractors.

The Contracting Officer or the Architect will not undertake to settle any differences between the Contractor and his Subcontractors or between Subcontractors.

42. ARCHITECT'S STATUS:

The Architect named in the Contract Documents, who prepared and furnished the Working Drawings and the Specifications contained therein, will prepare details and explanatory drawings, and provide instructions during the progress of the work for transmittal by the Contracting Officer or Architect as above set forth under paragraph 3, ADDITIONAL DETAIL DRAWINGS AND INSTRUCTIONS. He will make his check of manufacturers' data and shop drawings submitted by the Contractor for the Work as above set forth under 5, SHOP DRAWINGS.

The Architect will endeavor to require the Contractor to strictly adhere to the plans and specifications, to guard the Owner against defects and deficiencies in the work of Contractors, and shall promptly notify the Contracting Officer in writing of any significant departure in the quality of materials or workmanship from the requirements of the plans and specifications, but he does not guarantee the performance of the contracts.

The Architect shall not be responsible for construction means, methods, techniques, sequences or procedures, or for safety precautions and programs in connection with the Work, unless spelled out in the Contract Documents, and he shall not be liable for results of the Contractor's failure to carry out the work in accordance with the Contract Documents.

The Architect shall have authority to require the Contractor to stop the Work whenever in his opinion it may be necessary for the proper performance of the Contract. The Architect shall not be liable to the Owner for the consequences of any decision made by him in good faith either to exercise or not to exercise his authority to stop the Work.

The Architect shall not be responsible for the acts or omissions of the Contractor, or any Subcontractors, or any of the Contractor's or Subcontractor's agents or employees, or any other persons performing any of the Work.

43. ARCHITECT'S DECISIONS:

The Architect's decisions in matters relating to the artistic effect of his work shall be final, if within the other terms of the Contract.

44. CONTRACTING OFFICER'S DECISIONS:

Except as hereinafter provided, any claim or question concerning the interpretation or meaning of the Contract Documents, or concerning a breach of the Contract, shall be submitted to the Contracting Officer and his decision shall be final, binding, and conclusive on the parties to the Contract. He shall have executive authority to enforce and make effective such decisions and orders as the Contractor fails to carry out promptly.

45. CASH ALLOWANCES:

No cash allowances shall be included in the Contract Price, unless specifically set forth under SPECIAL CONDITIONS or MODIFICATIONS of the GENERAL CONDITIONS. When so included, the Contractor shall include in the Contract Price all allowances named therein and shall cause the work so covered to be done by such subcontractors, material, and/or equipment men, and for such sums as the Contracting Officer approves, and the Contract Price shall be adjusted in conformance therewith. The Contract Price shall include all the Contractor's expense, overhead, and profit, and no allowance, other than that included in the Contract Price, will be paid by the Owner.

46. USE OF PREMISES; SANITARY PROVISIONS:

The Contractor shall take every precaution against injuries to persons or damages to property.

The Contractor shall comply with local and State regulations governing the operation of premises which are occupied and shall perform the Contract in such a manner as not to interrupt or interfere with the operation of any other facility.

The Contractor shall store his apparatus, materials, supplies, and equipment in such orderly fashion at the site of the Work as will not unduly interfere with the progress of his work or the work of any other contractors.

Unless otherwise provided, temporary storage sheds, shops, and office facilities may be erected on the premises with the approval of the Architect or the Contracting Officer. Such temporary buildings and/or utilities shall remain the property of the Contractor and be removed at his expense upon completion of the Work, unless the Owner authorized their abandonment without removal.

Necessary crossings of curbings, sidewalks, roadways, or parkways shall be protected against damage, and any damage shall be repaired by or at the expense of the Contractor.

The Contractor shall not place upon the Work or any part thereof loads inconsistent with the safety of that portion of the Work.

No Contractor shall perform any work necessary to be performed after regular working hours or on Sundays or legal holidays without extra compensation.

The Contractor shall provide and maintain such sanitary accommodations for the use of his employees and those of his subcontractors as may be necessary to comply with the requirements and regulations of the local and State Department of Health and as directed.

47. CUTTING AND PATCHING:

The Contractor shall do all necessary cutting, fitting, and patching of the Work that maybe required to properly receive the Work to make its several parts join together properly, receive and provide for the work of various trades, and be received by the work of other contractors, or as required by Drawings and Specifications to complete the Work. After such cutting, he shall replace or restore or repair and make good all defective or patched work as required by the Architect. He shall not cut, excavate, or otherwise alter any work in a manner or by a method or methods that will endanger the Work, adjacent property, workmen, the public, or the work of any other contractor.

The Contractor shall have his Subcontractor check the location of all sleeves, openings, slots, etc., for the piping, ducts, breeching, conduits, louvers, grilles, fans, etc., as they are laid out on the job.

Provision for openings, holes, and clearances through walls, beams, floors, ceilings, and partitions shall be made and checked by the Contractor and/or his Subcontractor in advance of constructing such parts of the Work, and unnecessary, superfluous or dangerous cutting avoided.

Pipes passing through concrete or masonry walls shall be protected by pipe sleeves two sizes larger than the pipe, plus its insulation, to provide free movement.

Under no condition shall structural, framing, or other parts or members subjected to computed stress be cut or disturbed without the approval of the Architect. Any plates, studs, or joists, and/or rafters that are approved to be cut to execute necessary work shall be securely strapped and braced to restore their original strength by an approved method.

The Architect's approval shall be obtained before cutting or drilling holes in concrete or masonry that tend to damage or weaken the load capacity.

48. PERIODIC AND FINAL CLEANUP:

The Contractor shall periodically, or as directed during the progress of the Work, clean up and remove from the premises all refuse, rubbish, scrap materials and debris caused by his employees, his Subcontractors, or resulting from his work, to the end that at all times the premises are sanitary, safe, reasonably clean, orderly, and workmanlike. Trash and combustible materials shall not be allowed to accumulate inside buildings or elsewhere on the premises. At no time shall any rubbish be thrown from window openings.

Before final completion and final acceptance the Contractor shall remove from the Owner's property, and from all public and private property, all tools, scaffolding, false work, temporary structures, and/or utilities

including the foundations thereof (except such as the Owner permits in writing to remain); rubbish and waste materials resulting from his operations or caused by his employees; and shall remove all surplus materials, leaving the site clean and true to line and grade, and the Work in a safe and clean condition, ready for use and operation.

In addition to the above, the Contractor shall be responsible for the following special cleaning for all trades as the work shall have been completed:

A. Cleaning of all painted, enameled, stained, or baked enamel work: Removal of all marks, stains, finger prints and splatters from such surfaces.

B. Cleaning of all glass: Cleaning and removing of all stickers, labels, stains, and paint from all glass, and the washing and polishing of same on interior and exterior.

C. Cleaning and polishing of all hardware.

D. Cleaning all tile, floor finish of all kinds: Removal of all splatter, stains, paint, dirt, and dust, the washing and polishing of all floors as recommended by the manufacturer or required by the Architect.

E. Cleaning of all manufactured articles, materials, fixtures, appliances, and equipment: Removal of all stickers, rust stains, labels, and temporary covers, and cleaning and conditioning of all manufactured articles, material, fixtures, appliances, and electrical, heating, and air conditioning equipment as recommended or directed by the manufacturers, unless otherwise required by the Architect; blowing out or flushing out of all foreign matter from all dust pockets, piping, tanks, pumps, fans, motors, devices, switches, panels, fixtures, boilers, similar features; and freeing identification plates on all equipment of excess paint and the polishing thereof.

In case of failure to comply with the above requirements for any part of the work within the time specified by the Architect, he may cause the Work to be done and deduct the cost thereof from the Contract Price on the next or succeeding Application for Payment.

49. GUARANTEE OF THE WORK:

Except as otherwise specified in the General Conditions or the Special Conditions, all work shall be guaranteed by the Contractor against defects resulting from the use of inferior materials, equipment, or workmanship for one year from the date of final completion of the Contract, or from full occupancy of the building by the Owner, whichever is earlier.

If, within any guarantee period, repairs or changes are required in connection with guaranteed work, which, in the opinion of the Contracting Officer or Architect are required as the result of the use of materials, equipment, or workmanship which are inferior, defective, or not in accordance with the terms of the Contract requirements, the Contractor, shall, promptly upon receipt of notice from the Owner, and without expense to the Owner:

A. Place in satisfactory condition in every particular all of such guaranteed work, correct all defects therein; and

B. Make good all damage to the building or site, or equipment or contents thereof, which, in the opinion of the Contracting Officer or Architect, is the result of the use of materials, equipment, or workmanship which are inferior, defective, or not in accordance with the terms of the Contract; and

C. Make good any work or material, or the equipment and contents of said building or site disturbed in fulfilling any such guarantee.

In any case where in fulfilling the requirements of the Contract or of any guarantee, embraced in or required thereby, the Contractor disturbs any work guaranteed under another contract, he shall restore such disturbed work to a condition satisfactory to the Contracting Officer and guarantee such restored work to the same extent as it was guaranteed under such other contract.

If the Contractor, after notice, fails to proceed promptly to comply with the terms of the guarantee, the Owner may have the defects corrected and the Contractor and his Surety shall be liable for all expense incurred.

All special guarantees applicable to definite parts of the work that may be stipulated in the Contract Documents shall be subject to the terms of this paragraph during the first year of the life of such special guarantee.

50. POSSESSION PRIOR TO COMPLETION:

The Owner shall have the right to use any completed or partially completed part of the Work. Such use shall not be deemed an acceptance of any work not completed in accordance with the contract requirements. If, however, such prior use by the Owner delays the progress of the Work or causes additional expenses to the Contractor, an equitable adjustment in the Contract Price and/or time of completion will be made and the Contract will be modified in writing accordingly.

51. LIQUIDATED DAMAGES:

Time is the essence of the Contract. Any delay in the completion of the Work as provided for in the Contract Documents will cause inconvenience to the public and loss and damage to the Owner in interest, and in additional administrative, architectural, inspection and supervision charges.

Therefore, a time charge equal to six per cent interest per annum on the total Contract Price will be made against the Contractor for the entire period that any part of the Work remains uncompleted after the time specified for the completion of the Work as provided in the Contract Documents, the amount of which shall be deducted by the Contracting Officer from the Final Estimate, and shall be retained by the Contracting Officer out of moneys otherwise due the Contractor in the Final Payment, not as a penalty, but as liquidated damages sustained, it being mutually understood and agreed between the parties hereto that such amount is reasonable as liquidated damages.

52. USE OF FOREIGN MATERIALS:

In accordance with ACT 876 of the 1961 Regular Session of the Alabama legislature the Contractor shall use only materials, supplies, and products manufactured, mined, processed or otherwise produced in the United States or its territories, if same are available at reasonable prices.

Breaching of this agreement shall render the Contractor liable for payment of liquidated damages in the amount of not less than $500.00 nor more than 20% of the gross amount of the contract.

This requirement applies to all contracts for public works financed entirely with State of Alabama funds.

53. WITHHOLDING OF FUNDS (1977 DEC)

A. The Contracting Officer may withhold or cause to be withheld from the prime contractor so much of the accrued payments or advances as maybe considered necessary (1) to pay laborers and mechanics, including apprentices, trainees, watchmen and guards, employed by the Contractor or any subcontractor on the work the full amount of wages required by the contract, and (2) to satisfy any liability of the Contractor and any subcontractor for liquidated damages under paragraph (B) of the clause entitled "Contract Work Hours and Safety Standards Act - Overtime Compensation."

B. If the Contractor or any subcontractor fails to pay any laborer, mechanic, apprentice, trainee, watchman, or guard employed or working on the site of the work all or part of the wages required by the contract, the Contracting Officer may, after written notice to the prime contractor, take such action as may be necessary to cause suspension of any further payments or advances until such violations have ceased.

54. DISPUTES CONCERNING LABOR STANDARDS (ASPR 7-602.23)(77 DEC)

Disputes arising out of the labor standards provisions of this contract shall be subject to the DISPUTES clause except to the extent such disputes involve the meaning of classifications or wage rates contained in the wage determination decision of the Secretary of Labor or the applicability of the labor provisions of this

contract which questions shall be referred to the Secretary of Labor in accordance with the procedures of the Department of Labor.

55. DISPUTES

Except as otherwise specifically provided in this contract, and except as otherwise specifically provided by the State procedure for arbitration or other State procedure established by State law, any dispute concerning a question of fact arising under this contract which is not disposed of by mutual agreement shall be decided by the Contracting Officer, who shall reduce his decision to writing and send by registered mail, return receipt requested, a copy thereof to the Contractor at his address shown herein. Within thirty (30) days after the date of receipt of such copy, the Contractor may appeal in writing to the Governor of this State, whose written decision therein, or that of his designated representative or representatives, shall, unless determined by a court of competent jurisdiction to have been fraudulent or capricious or arbitrary or so grossly erroneous as necessarily to imply bad faith, or not supported by substantial evidence, be final and conclusive: Provided, that if no such appeal is taken, the decision of the Contracting Officer shall be final and conclusive. The Governor of this State may designate an individual or individuals other than the Contracting Officer, or a board, as his authorized representative to determine appeals under this Article. In connection with any appeal proceeding under this Clause, the Contractor shall be afforded an opportunity to be heard and to offer evidence in support of his appeal. Pending final decision of a dispute hereunder, the Contractor shall proceed diligently with the performance of the contract and in accordance with the Contracting Officer's decision. Any sum or sums allowed to the Contractor under the provisions of this Article or under the State Arbitration proceedings or under other State procedure shall be paid subject to approval of the Chief, National Guard Bureau, for the Government's share of the cost of the Articles or work herein disputed as deemed to be within the contemplation of this contract.

56. EQUAL OPPORTUNITY (FEDERALLY ASSISTED CONSTRUCTION) (ASPR 7-103.18)(1978 SEP)

If, during any twelve (12) month period (including the 12 months preceding the award of this contract), the Contractor has been or is awarded Federal contracts and/or subcontracts which have an aggregate value in excess of $10,000, the Contractor shall comply with (A) through (G) below. Upon request, the Contractor shall provide information necessary to determine the applicability of this clause.)

The applicant hereby agrees that it will incorporate or cause to be incorporated into any contract for construction work, or modification thereof, as defined in the Regulations of the Secretary of Labor at 41 CFR Chapter 60, which is paid for in whole or in part with funds obtained from the Federal Government or borrowed on the credit of the Federal Government pursuant to a grant, contract, loan, insurance, or guarantee, or undertaken pursuant to any Federal program involving such grant, contract, loan, insurance, or guarantee, the following Equal Opportunity clause:

During the performance of this contract, the Contractor agrees as follows:

A. The Contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex or national origin. The Contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, or national origin. Such action shall include but not be limited to the following: Employment, upgrading, demotion, or transfer, recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided setting forth the provisions of this nondiscrimination clause.

B. The Contractor will, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex or national origin.

C. The Contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice to be provided advising the said labor union or workers representatives of the Contractor's commitments under this section, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

D. The Contractor will comply with all provisions of Executive Order 11246 of September 24, 1965, as amended by Executive Order 11375 of October 13, 1967, and of the rules, regulations and relevant orders of the Secretary of Labor.

E. The Contractor will furnish all information and reports required by Executive Order 11246 of September 24, 1965, as amended by Executive Order 11375 of October 13, 1967, and by rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records and accounts by the administering agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

F. In the event of the Contractor's noncompliance with the nondiscrimination clauses of this contract or with any of the said rules, regulations or orders, this contract may be cancelled, terminated or suspended in whole or in part and the Contractor may be declared ineligible for further Government contracts or Federally assisted construction contracts in accordance with procedures authorized in Executive Order 11246 of September 24, 1965, as amended by Executive Order 11375 of October 13, 1967, and such other sanctions may be imposed and remedies invoked as provided in Executive Order 11246 of September 24, 1965, as amended by Executive Order 11375 of October 13, 1967, or by rule, regulation or order of the Secretary of Labor, or as otherwise provided by law.

G. The Contractor will include the portion of the sentence immediately preceding paragraph (A) and the provisions of paragraphs (A) through (G) in every subcontract or purchase order unless exempted by rules, regulations or orders of the Secretary of Labor issued pursuant to Section 204 of Executive Order 11246 of September 24, 1965, as amended by Executive Order 11375 of October 13, 1967, so that such provisions will be binding upon each subcontractor or vendor. The Contractor will take such action with respect to any subcontract or purchase order as the administering agency may direct as a means of enforcing such provisions, including sanctions for noncompliance: *Provided, however,* that in the event a Contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by the administering agency, the Contractor may request the United States to enter into such litigation to protect the interests of the United States. The applicant further agrees that it will be bound by the above Equal Opportunity Clause with respect to its own employment practices when it participates in Federally assisted construction work: Provided, that if the applicant so participating is a State or local government, the above Equal Opportunity Clause is not applicable to any agency, instrumentality or subdivision of such government which does not participate in work on or under the contract. The applicant agrees that it will assist and cooperate actively with the administering agency and the Secretary of Labor in obtaining the compliance of Contractors and subcontractors with the Equal Opportunity Clause and the rules, regulations and relevant orders of the Secretary of Labor, that it will furnish the administering agency and the Secretary of Labor such information as they may require for the supervision of such compliance, and that it will otherwise assist the administering agency in the discharge of the agency's primary responsibility for securing compliance. The applicant further agrees that it will refrain from entering into any contract or contract modification subject to Executive Order 11246 of September 24, 1965, as amended by Executive Order 11375 of October 13, 1967, with a Contractor debarred from, or who has not demonstrated eligibility for, Government contracts and Federally assisted construction contracts pursuant to the Executive Order and will carry out such sanctions and penalties for violation of the Equal Opportunity Clause as may be imposed upon Contractors and subcontractors by the administering agency or the Secretary of Labor pursuant to Part II, Subpart D of the Executive Order. In addition, the applicant agrees that if it fails or refuses to comply with these undertakings, the administering agency may take any or all of the following actions: cancel, terminate or suspend in whole or in part this grant (contract, loan, insurance, guarantee); refrain from extending any further assistance to the applicant under the program with respect to which the failure or refusal occurred until satisfactory assurance of future compliance has been received from such applicant; and refer the case to the Department of Justice for appropriate legal proceedings.

57. CERTIFICATION OF NONSEGREGATED FACILITIES (1970 AUG) (ASPR 7-2003.14)

(Applicable to contracts, subcontracts, and to agreements with applicants who are themselves performing Federally assisted construction contracts, exceeding $10,000 which are not exempt from the provisions of the Equal Opportunity Clause). By the submission of this bid, the bidder, offeror, applicant, or subcontractor certifies that he does not maintain or provide for his employees any segregated facilities at any of his establishments, and that he does not permit his employees to perform their services at any location, under his control, where segregated facilities are maintained. He certifies further that he will not maintain or provide for his employees any segregated facilities at any of his establishments, and that he will not permit his employees to perform their services at any location, under his control, where segregated facilities are

maintained. The bidder, offeror, applicant, or subcontractor agrees that a breach of this certification is a violation of the Equal Opportunity Clause in this contract. As used in this certification, the term "segregated facilities" means any waiting rooms, work areas, rest rooms and wash rooms, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees which are segregated by explicit directive or are in fact segregated on the basis of race, color, religion or national origin, because of habit, local custom or otherwise. He further agrees that (except where he has obtained identical certifications from proposed subcontractors for specific time periods) he will obtain identical certifications from proposed subcontractors prior to the award of subcontracts exceeding $10,000 which are not exempt from the provisions of Equal Opportunity Clause; that he will retain such certifications in his files; and that he will forward the following notice to such proposed subcontractors (except where the proposed subcontractors have submitted identical certifications for specific time periods).

NOTICE TO PROSPECTIVE SUBCONTRACTORS OF REQUIREMENT FOR CERTIFICATIONS OF NONSEGREGATED FACILITIES:

A Certification of Nonsegregated Facilities must be submitted prior to the award of a subcontract exceeding $10,000 which is not exempt from the provisions of the Equal Opportunity Clause. The certification may be submitted either for each subcontract or for all subcontracts during a period (i.e., quarterly, semiannually, or annually).

NOTE: The penalty for making false statements in offers is prescribed in 18 U.S.C. 1001.

58. EXEMPTIONS TO EQUAL OPPORTUNITY CLAUSES (ASPR 12-805) (JUL 76)

A. *Transactions of $10,000 or Under.* Contracts and subcontracts not exceeding $10,000, other than Government bills of lading, are exempt from the requirements of the Equal Opportunity Clause. In determining the applicability of this exemption to any Federally assisted construction contract, or subcontract thereunder, the amount thereof rather than the amount of the Federal financial assistance shall govern. Indefinite delivery type contracts and subcontracts thereunder, basic agreements and basic ordering agreements shall include the Equal Opportunity Clause, except when the Contracting Officer (in the case of subcontractors, the prime contractor or subcontractors issuing the subcontract) determines that the amount to be ordered is not expected to extend $10,000 in any single year. The applicability of the Equal Opportunity Clause shall be determined by the Contracting Officer at the time of award for the first year, and annually thereafter for succeeding years if any. Notwithstanding the above, the Equal Opportunity Clause shall be incorporated into such contract, subcontract, basic agreement or basic ordering agreement whenever the amount of a single order or procurement action exceeds $10,000. Once the clause is incorporated, the contract, subcontract, basic agreement, or basic ordering agreement shall continue to be subject to such clause for its duration, regardless of the amounts ordered, or reasonably expected to be ordered, in any year. No Contracting Officer, Contractor, or Subcontractor, shall procure supplies or services in less than usual quantities to avoid applicability of the Equal Opportunity Clause.

B. *Work Outside the United States.* Contracts and subcontracts are exempt from the requirement of the Equal Opportunity Clause with regard to work performed outside the United States by employees who were not recruited within the United States.

C. *Contracts with State or Local Governments.* The requirements of the clause in any contract or subcontract with a State or local government (or any agency, instrumentality or subdivision thereof) shall not be applicable to any agency, instrumentality or subdivision of such government which does not participate in work on or under the contract or subcontract. In addition, State and local governments are exempt from the requirements of filing the annual compliance report provided for by 12-812(a) and maintaining a written affirmative action program prescribed by 12-807.1.

D. Contracts Exempted by the Secretary of Defense in the Interest of National Security.

(1) Any requirement set forth in this Part shall not apply to any contract or subcontract whenever the Secretary of Defense determines that such contract or subcontract is essential to the national security and that its award without complying with such requirement is necessary to the national security.

(2) *Requests for Exemption:* The Contracting Officer shall prepare a detailed justification for such determination which shall be submitted to the ASD(M&RA) in accordance with Departmental procedures.

The ASD(M&RA) shall submit the request for exemption to the Secretary of Defense for approval, and shall notify the Director, OFCC, within 30 days of such a determination.

E. Specific Contracts and Facilities Exempted by the Director, OFCC.

(1) *Specific Contracts.* The Director, OFCC, may exempt an agency or person from requiring the inclusion of any or all of the Equal Opportunity Clause in any specific contract or subcontract when he deems that special circumstances in the national interest so require. He may also exempt groups or categories of contracts or subcontracts of the same type where he finds it impracticable to act upon each request individually or where group exemptions will contribute to convenience in the administration of the Order.

(2) *Facilities Not Connected with Contracts.* The Director, OFCC, may exempt from the requirements of the clause any of a prime contractor's or a subcontractor's facilities which he finds to be in all respects separate and distinct from activities of the prime contractor or subcontractor related to the performance of the contract or subcontract, provided that he also finds that such an exemption will not interfere with or impede the effectuation of the Order.

(3) *Special Circumstances.* The Director, OFCC, may exempt a contract or subcontract when he finds that special circumstances indicate that use of either of the clauses in 7-103.18 in the contract or subcontract would not be in the national interest.

(4) *Request for Exemptions.* The Contracting Officer shall submit a detailed justification for omitting or modifying the clause under (1), (2) or (3) above to the ASD (M&RA) in accordance with Departmental procedures.

(5) *Withdrawal of Exemption by the Director, OFCC.* When any contract or subcontract is of a class exempted under this paragraph 12-805, the Director, OFCC, may withdraw the exemption for a specific contract or subcontract or group of contracts or subcontracts when in his judgement such action is necessary or appropriate to achieve the purposes of the Order. Such withdrawal shall not apply to contracts or subcontracts awarded prior to the withdrawal. In procurements entered into by formal advertising or the various forms of restricted formal advertising, such withdrawal shall not apply unless the withdrawal is made more than 10 calendar days before the date set for the opening of the bids.

59. CLEAN AIR AND WATER (1975 OCT)(ASPR 7-103.29)

(Applicable only if the contract exceeds $100,000, or the Contracting Officer has determined that orders under an indefinite quantity contract in any one year will exceed $100,000, or a facility to be used has been the subject of a conviction under the Clean Air Act (42 U.S.C. 1857c-8(c)(1) or the Federal Water Pollution Control Act (33 U.S.C. 1319(c) and is listed by EPA, or the contract is not otherwise exempt.)

A. The Contractor agrees as follows:

(1) To comply with all the requirements of Section 114 of the Clean Air Act, as amended (42 U.S.C. 1857, et seq., as amended by Public Law 91-604) and Section 308 of the Federal Water Pollution Control Act (33 U.S.C. 1251, as amended by Public Law 92-500), respectively, relating to inspection, monitoring, entry, reports, and information, as well as other requirements specified in Section 114 and Section 308 of the Air Act and the Water Act, respectively, and all regulations and guidelines issued thereunder before the award of this contract.

(2) That no portion of the work required by this prime contract will be performed in a facility listed on the Environmental Protection Agency List of Violating Facilities on the date this contract was awarded unless and until the EPA eliminates the name of such facility or facilities from such listing.

(3) To use his best efforts to comply with clean air standards and clean water standards at the facilities in which the contract is being performed; and

(4) To insert the substance of the provisions of this clause in any nonexempt subcontract, including this paragraph (4).

B. The terms used in this clause have the following meanings:

(1) The term "Air Act" means the Clean Air Act, as amended (42 U.S.C. 1857 et seq., as amended by Public Law 91-604).

(2) The term "Air Act" means Federal Water Pollution Control Act, as amended (33 U.S.C. 1251 et seq., as amended by Public Law 92-500).

(3) The term "Clean Air Standards" means any enforceable rules, regulations, guidelines, standards, limitations, orders, controls, prohibitions, or other requirements which are contained in, issued under, or otherwise adopted pursuant to the Air Act or Executive Order 11738, an applicable implementation plan as described in Section 110(d) of the Clean Air Act (42 U.S.C. 1857c-5(d), an approved implementation procedure or plan under Section 111(c) or Section 111(d), respectively of the Air Act (42 U.S.C. 1857c-6(c) or (d), or an approved implementation procedure under Section 112(d) of the Air Act (42 U.S.C. 1857c-7(d).

(4) The term "Clean Water Standards" means any enforceable limitation, control, condition, prohibition, standard or other requirement which is promulgated pursuant to the Water Act or obtained in a permit issued to a discharger by the Environmental Protection Agency or by a State under an approved program, as authorized by Section 402 of the Water Act (33 U.S.C. 1342), or by a local government to ensure compliance with pretreatment regulations as required by Section 307 of the Water Act (33 U.S.C. 1317).

(5) The term "compliance" means compliance with clean air or water standards. Compliance shall also mean compliance with a schedule or plan ordered or approved by a court of competent jurisdiction, the Environmental Protection Agency or an air or water pollution control agency in accordance with the requirement of the Air Act or Water Act and regulations issued pursuant thereto.

(6) The term "facility" means any building, plant, installation, structure, mine, vessel or other floating craft, location, or site of operations, owned, leased, or supervised by a contractor, subcontractor, to be utilized in the performance of a contract or subcontract. Where a location or site of operations contains or includes more than one building, plant, installation, or structure, the entire location or site shall be deemed to be a facility except there the Director, Office of Federal Activities, Environmental Protection Agency, determines that independent facilities are collocated in one geographical area.

(7) The term "nonexempt contract or subcontract" means a contract or subcontract of more than $100,000 which is not otherwise exempted pursuant to the EPA regulations implementing the Air Act and Water Act (40 CFR 15.5), as further implemented in ASPR 1-2302.4 or in FPR 1-1.2302-4 whichever is applicable) and the procedures of the Department awarding the contract.

60. CLEAN AIR AND WATER CERTIFICATION (77 JUN) (DAR 7-2003.71)

Applicable if the bid or offer exceeds $100,000, or the Contracting Officer has determined that orders under an indefinite quantity contract in any year will exceed $100,000, or a facility to be used has been the subject of a conviction under the Clean Air Act (42 U.S.C. 1857c-8(c)(1)) or the Federal Water Pollution Control Act (33 U.S.C. 1319(c)) and is listed by EPA, or is not otherwise exempt.

The Bidder or offeror certifies as follows:

(1) Any facility to be utilized in the performance of this proposed contract is (_) or is not (_), listed on the Environmental Protection Agency List of Violating Facilities;

(2) He will promptly notify the Contracting Officer, prior to award, of the receipt of any communication from the Director, Office of Federal Activities, U. S. Environmental Protection Agency, indicating that any facility which he proposes to use for the performance of the contract is under consideration to be listed on the EPA List of Violating Facilities; and

(3) He will include substantially this solicitation certification, including this paragraph (3), in every nonexempt subcontract.

61. EXEMPTIONS TO ENVIRONMENTAL PROTECTION CLAUSE (ASPR 1-2302.4) (JUL 76)

Except as provided in (c) below, contracts and subcontracts are exempt from the requirements of this Part and 40 CFR Part 15, as follows:

A. Contracts and subcontracts not exceeding $100,000 are exempt.

B. Contracts and subcontracts for indefinite quantities are exempt if the Contracting Officer determines that the amount to be ordered in any year under such contract will not exceed $100,000.

C. Except for small purchases, the foregoing exemptions shall not apply to a proposed contract under which the facility to be used is listed on the EPA List of Violating Facilities on the basis of a conviction either under the Air Act (40 U.S.C. 1857-8(c)(1) or the Water Act (33 U.S.C. 1319(c)).

D. This part and 40 CFR Part 15 do not apply to the use of facilities located outside the United States. The term "United States," as used herein, includes the States, District of Columbia, Commonwealth of Puerto Rico, Virgin Islands, Guam and American Samoa, and Trust Territories of the Pacific Islands.

E. Upon a determination that the paramount interest of the United States so requires, the Secretary concerned may except from the provisions of this Part any individual or class of contracts or subcontracts, for a period of one year. Prior to granting a class exemption, the Secretary shall consult with the Director, Office of Federal Activities, United States Environmental Protection Agency. The Secretary granting either an individual contract or class exemption shall notify the Director of such exemption as soon after granting the exemption as practicable. Such notification shall describe the purpose of the contract, and indicate the manner in which the paramount interest of the United States required that the exemption be made.

62. AFFIRMATIVE ACTION FOR HANDICAPPED WORKERS (ASPR 7-103.28) (76 MAY)

A. The Contractor will not discriminate against any employee or applicant for employment because of physical or mental handicap in regard to any position for which the employee or applicant for employment is qualified. The Contractor agrees to take affirmative action to employ, advance in employment and otherwise treat qualified handicapped individuals without discrimination based upon either physical or mental handicap in all employment practices such as the following: employment, upgrading, demotion or transfer, recruitment, advertising, layoff or termination, rates of pay or other forms of compensation, and selection for training, including apprenticeship.

B. The Contractor agrees to comply with the rules, regulations, and relevant orders of the Secretary of Labor issued pursuant to the Act.

C. In the event of the Contractor's noncompliance with the requirements of this clause, action for noncompliance may be taken in accordance with the rules, regulations and relevant orders of the Secretary of Labor issued pursuant to the Act.

D. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices in a form to be prescribed by the Director, provided by or through the Contracting Officer. Such notices shall state the Contractor's obligation under the law to take affirmative action to employ and advance in employment qualified handicapped employees and applicants for employment, and the rights of applicants and employees.

E. The Contractor will notify each labor union or representative of workers with which it has a collective bargaining agreement or other contract understanding, that the Contractor is bound by the terms of Section 503 of the Rehabilitation Act of 1973, and is committed to take affirmative action to employ and advance in employment physically and mentally handicapped individuals.

F. The Contractor will include the provisions of this clause in every subcontract or purchase order of $2500 or more unless exempt by rules, regulations, or orders of the Secretary issued pursuant to Section 503 of the Act, so that such provisions will be binding upon each subcontractor or vendor. The Contractor will take such action with respect to any subcontract or purchase order as the Director of the Office of Federal Contract Compliance Programs may direct to enforce such provisions, including action for noncompliance.

63. COVENANT AGAINST CONTINGENT FEES

The Contractor warrants that no person or selling agency has been employed or retained to solicit or secure this contract upon an agreement or understanding for a commission, percentage, brokerage, or contingent fee, excepting bona fide employees or bona fide established commercial or selling agencies maintained by the Contractor for the purpose of securing business. For breach or violation of this warranty, the Owner shall have the right to annul this contract without liability or in its discretion to deduct from the contract price or consideration the full amount of such commission, percentage, brokerage, or contingent fee.

64. OFFICIALS NOT TO BENEFIT

No member of or delegate to Congress or resident commissioner shall be admitted to any share or part of this contract, or to any benefit that may arise therefrom; but this provision shall not be construed to extend to this contract if made with a corporation for its general benefit.

65. CONVICT LABOR

In connection with the performance of work under this contract, the Contractor agrees not to employ any person undergoing sentence of imprisonment, as provided by Public Law 89-176, September 10, 1965 (18 U.S.C. 4082(c)(2)) and Executive Order 11755, December 29, 1973.

66. NONDISCRIMINATION IN EMPLOYMENT

In connection with the performance of work under this contract, the Contractor agrees not to discriminate against any employee or applicant for employment because of sex, race, creed, color, or national origin; and further agrees to insert the foregoing provision in all subcontracts hereunder except subcontracts for standard commercial supplies or for raw materials.

67. GRATUITIES

A. The State may, by written notice to the Contractor, terminate the right of the Contractor to proceed under this contract if it is found, after notice and hearing, by the Contracting Officer or Governor or the duly authorized representative of either, that gratuities (in the form of entertainment, gifts, or otherwise) were offered or given by the Contractor, or any agent or representative of the Contractor, to any officer or employee of the State with a view toward securing a contract or securing favorable treatment with respect to the awarding or amending, or the making of any determinations with respect to the performance of such contract: Provided, that the existence of the facts upon which the Contracting Officer or Governor or the duly authorized representative of either makes such findings shall be in issue and may be reviewed in any competent court.

B. In the event this contract is terminated as provided in paragraph (a) hereof, the State shall be entitled (1) to pursue the same remedies against the Contractor as it could pursue in the event of a breach of the contract by the Contractor, and (2) as a penalty in addition to any other damages to which it may be entitled by law, to exemplary damages in an amount (as determined by the Contracting Officer or Governor or the duly authorized representative of either) which shall not be less than 3 nor more than 10 times the costs incurred by the Contractor in providing any such gratuities to any such officer or employee.

C. The rights and remedies of the State provided in this Clause shall not be exclusive and are in addition to any other rights and remedies provided by law or under this contract.

68. COPELAND ("ANTI-KICKBACK") ACT - NONREBATE OF WAGES

The regulations of the Secretary of Labor applicable to contractors and subcontractors (29 CFR, Part 3), made pursuant to the Copeland Act, as amended (40 U.S.C. 276c) and to aide in the enforcement of the Anti - Kickback Act (18 U.S.C. 874) are made a part of this contract by reference. The Contractor will comply with these regulations and any amendments or modifications thereof and the prime contractor will be responsible for the submission of affidavits required of subcontractors thereunder. The foregoing shall apply except as the Secretary of Labor may specifically provide for reasonable limitations, variations, tolerances and exemptions.

69. SUBCONTRACTS - TERMINATION

The Contractor agrees to insert the clauses hereof entitled COPELAND ("ANTI-KICKBACK") ACT - NONREBATE OF WAGES, WITHHOLDING OF FUNDS, and SUBCONTRACTS - TERMINATION physically in all subcontracts and the Contractor further agrees that a breach of any of the requirements of these clauses may be grounds for termination of this contract. The term "contractor" as used in such clauses in any subcontract shall be deemed to refer to the subcontractor except in the phrase "prime contractor."

70. AUDIT BY DEPARTMENT OF DEFENSE (1978 AUG)

A. General. The Contracting Officer or his representatives shall have the audit and inspection rights described in the applicable paragraphs (B), (C) and (D) below.

B. Examination of Costs. If this is a cost reimbursement type, incentive, time and materials, labor hour, or price redeterminable contract, or any combination thereof, the Contractor shall maintain, and the Contracting Officer or his representatives shall have the right to examine books, records, documents, and other evidence and accounting procedures and practices, sufficient to reflect properly all direct and indirect costs of whatever nature claimed to have been incurred and anticipated to be incurred for the performance of this contract. Such right of examination shall include inspection at all reasonable times of the Contractor's plants, or such parts thereof, as may be engaged in the performance of this contract.

C. Cost or Pricing Data. If the Contractor submitted cost or pricing data in connection with the pricing of this contract or any change or modification thereto, unless such pricing was based on adequate price competition, established catalog or market prices of commercial items sold in substantial quantities to the general public, or prices set by law or regulation, the Contracting Officer or his representatives who are employees of the United States Government shall have the right to examine all books, records, documents and other data of the Contractor related to the negotiation, pricing or performance of such contract, change or modification, for the purpose of evaluating the accuracy, completeness and currency of the cost or pricing data submitted. The right of examination shall extend to all documents necessary to permit adequate evaluation of the cost or pricing data submitted, along with the computations and projections used therein.

D. Reports. If the Contractor is required to furnish Contractor Cost Data Reports (CCDR), Contract Fund Status Reports (CFSR), or Cost Performance Reports (CPR), the Contracting Officer or his representatives shall have the right to examine books, records, other documents, and other supporting materials, for the purpose of evaluating (i) the effectiveness of the Contractor's policies and procedures to produce data compatible with the objectives of these reports, and (ii) the data reported.

E. Availability. The materials described in (B), (C) and (D) above shall be made available at the office of the Contractor, at all reasonable times, for inspection, audit, or reproduction, until the expiration of three (3) years from the date of final payment under this contract or such lesser time specified in Appendix M of the Defense Acquisition Regulation and for such longer period, if any, as is required by applicable statute, or by other clauses of this contract, or by (1) and (2) below:

(1) If this contract is completely or partially terminated, the records relating to the work terminated shall be made available for a period of three (3) years from the date of any resulting final settlement.

(2) Records which relate to appeals under the DISPUTES Clause of this contract, or litigation, or the settlement of claims arising out of the performance of this contract, shall be made available until such appeals, litigation, or claims have been disposed of.

F. The Contractor shall insert a clause containing all the provisions of this clause, including this paragraph (F), in all subcontracts exceeding $10,000 hereunder, except altered as necessary for proper identification of the contracting parties and the Contracting Officer under the State prime contract.

71. SUBCONTRACTOR COST OR PRICING DATA - PRICE ADJUSTMENTS (1970 JAN)

A. Paragraphs (B) and (C) of this Clause shall become operative with respect to any modification made pursuant to one or more provisions of this contract which involves aggregate increases and/or decreases in costs plus applicable profits expected to exceed $100,000. The requirements of this Clause shall be limited to such modifications.

B. The Contractor shall require subcontractors hereunder to submit cost or pricing data under the following circumstances:

(1) prior to the award of any subcontract the amount of which is expected to exceed $100,000 when entered into;

(2) prior to the pricing of any subcontract modification which involves aggregate increases and/or decreases in costs plus applicable profits expected to exceed $100,000; except where the price is based on adequate price competition, established catalog or market prices of commercial items sold in substantial quantities to the general public, or prices set by law or regulation.

C. The Contractor shall insert the substance of this clause including this paragraph (C) in each subcontract which exceeds $100,000.

72. BUY AMERICAN ACT (1966 OCT)

A. Agreement. In accordance with the Buy American Act (41 U.S.C. l0a - l0d), the Contractor agrees that only domestic construction material will be used (by the Contractor, subcontractors, materialmen, and suppliers) in the performance of this contract, except for non-domestic construction material listed in the "Nondomestic Construction Materials" clause, if any, of this contract.

B. Domestic construction material. "Construction material" means any article, material, or supply brought to the construction site for incorporation in the building or work. An unmanufactured construction material is a "domestic construction material" if it has been mined or produced in the United States. A manufactured construction material is a "domestic construction material" if it has been manufactured in the United States and if the cost of its components which have been mined, produced, or manufactured in the United States exceeds 50 percent of the cost of all its components. "Component" means any article, material, or supply directly incorporated in a construction material.

C. Domestic component. A component shall be considered to have been mined, produced, or manufactured in the United States" (regardless of its source in fact) if the article, material, or supply in which it is incorporated was manufactured in the United States and the component is of a class or kind determined by the Government to be not mined, produced, or manufactured in the United States in sufficient and reasonably available commercial quantities and of a satisfactory quality.

D. Non-Domestic construction material. The Contractor/Vendor agrees that it will not expend any funds appropriated by Congress without complying with The Buy American Act (41 U.S.C. 10). The Buy American Act gives preference to domestic end products and domestic construction material. In addition, the Memorandum of Understanding between the United States of America and the European Economic Community on Government Procurement, and the North American Free Trade Agreement (NAFTA), provide that EC and NAFTA end products and construction materials are exempted from application of the Buy American Act.

73. APPROVAL

This contract and any subsequent terminations, modifications, or change orders (including those resulting from disputes and settlements of disputes) shall be subject to the written approval of the Chief, National Guard Bureau, or his duly authorized representative, and shall not be binding until so approved.

74. SUBJECT TO FEDERAL-STATE AGREEMENT

This contract is subject to all terms and conditions of the Federal-State Agreement between the United States of America and the State of Alabama.

75. RELATIONSHIP OF THE FEDERAL GOVERNMENT

This contract is funded in part by the Federal Government. The Federal Government is not a party to this contract. As a condition to receiving and expending Federal funds, there are certain rights of Federal inspection, Federal approval of contract changes and modifications, and Federal approval of settlements or dispute actions that the Federal Government will exercise prior to authorization of Federal funds. Therefore, no inspection or acceptance, change, modification, settlement, dispute claim payment, or dispute action will be

considered binding until the required Federal approval is obtained. The Chief, National Guard Bureau, or his designated representative, is the approval authority. This paragraph does not abrogate any rights conferred on the Federal Government by law or other clause required due to the use of Federal funding.

76. SUSPENSION OF WORK (1968 FEB) (DAR 7-602.46)

A. The Contracting Officer may order the Contractor in writing to suspend, delay, or interrupt all or any part of the work for such period of time as he may determine to be appropriate for the convenience of the Owner.

B. If the performance of all or any part of the work is, for an unreasonable period of time, suspended, delayed, or interrupted by an act of the Contracting Officer in the administration of this contract, or by his failure to act within the time specified in this contract (or if no time is specified, within a reasonable time), an adjustment shall be made for any increase in the cost of performance of this contract (excluding profit) necessarily caused by such unreasonable suspension, delay, or interruption and the contract modified in writing accordingly. However, no adjustment shall be made under this clause for any suspension, delay, or interruption to the extent (1) that performance would have been so suspended, delayed, or interrupted by any other cause, including the fault or negligence of the Contractor, or (2) for which an equitable adjustment is provided for or excluded under any other provision of this contract.

C. No claim under this clause shall be allowed (1) for any costs incurred more than 20 days before the Contractor shall have notified the Contracting Officer in writing of the act or failure to act involved (but this requirement shall not apply as to a claim resulting from a suspension order), and (2) unless the claim, in a amount stated, is asserted in writing as soon as practicable after the termination of such suspension, delay, or interruption, but not later than the date of final payment under the contract.

77. TERMINATION FOR CONVENIENCE OF THE OWNER - CONSTRUCTION (1974 APR) (DAR 7-602.29)

A. The performance of work under this contract may be terminated by the Owner in accordance with this clause in whole, or from time to time in part, whenever the Contracting Officer shall determine that such termination is in the best interest of the Owner. Any such termination shall be effected by delivery to the Contractor of a Notice of Termination specifying the extent to which performance of work under the contract is terminated, and the date upon which such termination becomes effective.

B. After receipt of a Notice of Termination, and except as otherwise directed by the Contracting Officer, the Contractor shall:

(1) Stop work under the contract on the date and to the extent specified in the Notice of Termination;

(2) Place no further orders or subcontracts for materials, services or facilities, except as may be necessary for completion of such portion of the work under the contract as is not terminated;

(3) Terminate all orders and subcontracts to the extent that they relate to the performance of work terminated by the Notice of Termination;

(4) Assign to the Owner, in the manner, at the times, and to the extent directed by the Contracting Officer, all of the right, title, and interest of the Contractor under the orders and subcontracts so terminated, in which case the Owner shall have the right, in its discretion, to settle or pay any or all claims arising out of the termination of such orders and subcontracts;

(5) Settle all outstanding liabilities and all claims arising out of such termination of orders and subcontracts, with the approval or ratification of the Contracting Officer, to the extent he may require, which approval or ratification shall be final for all the purposes of this clause;

(6) Transfer title and deliver to the Owner, in the manner, at the times, and to the extent, if any, directed by the Contracting Officer, (a) the fabricated or unfabricated parts, work in process, completed work, supplies, and other materials produced as a part of, or required in connection with the performance of, the work terminated by the Notice of Termination, and (b) the completed or partially completed plans,

drawings, information, and other property which, if the contract had been completed, would have been required to be furnished to the Owner;

(7) Use his best efforts to sell, in the manner, at the times, to the extent, and at the price or prices directed or authorized by the Contracting Officer, any property of the types referred to in (6) above; provided, however, that the Contractor (a) shall not be required to extend credit to any purchaser, and (b) may acquire any such property under the conditions prescribed by and at a price or prices approved by the Contracting Officer; and provided further that the proceeds of any such transfer or disposition shall be applied in reduction of any payments to be made by the Owner to the Contractor under this contract or shall otherwise be credited to the price or cost of the work covered by this contract or paid in such other manner as the Contracting Officer may direct;

(8) Complete performance of such part of the work as shall not have been terminated by the Notice of Termination; and

(9) Take such action as may be necessary, or as the Contracting Officer may direct, for the protection and preservation of the property related to this contract which is in the possession of the Contractor and in which the Owner has or may acquire an interest.

At any time after expiration of the plant clearance period, as defined in Section VIII, Armed Services Procurement Regulation, as it may be amended from time to time, the Contractor may submit to the Contracting Officer a list, certified as to quantity and quality, of any or all items of termination inventory not previously disposed of, exclusive of items the disposition of which has been directed or authorized by the Contracting Officer, and may request the Owner to remove such items or enter into a storage agreement covering them. Not later than fifteen (15) days thereafter, the Owner will accept title to such items and remove them or enter into a storage agreement covering the same; provided, that the list submitted shall be subject to verification by the Contracting Officer upon removal of the items, or if the items are stored, within forty-five (45) days from the date of submission of the list, and any necessary adjustment to correct the list as submitted shall be made prior to final settlement.

C. After receipt of a Notice of Termination, the Contractor shall submit to the Contracting Officer his termination claim, in the form and with certification prescribed by the Contracting Officer. Such claim shall be submitted promptly but in no event later than one year from the effective date of termination, unless one or more extensions in writing are granted by the Contracting Officer, upon request of the Contractor made in writing within such one year period or authorized extension thereof. However, if the Contracting Officer determines that the facts justify such action, he may receive and act upon any such termination claim at any time after such one year period or any extension thereof. Upon failure of the Contractor to submit his termination claim within the time allowed, the Contracting Officer may determine, on the basis of information available to him, the amount, if any, due to the Contractor by reason of the termination and shall thereupon pay to the Contractor the amount so determined.

D. Subject to the provisions of paragraph C, the Contractor and the Contracting Officer may agree upon the whole or any part of the amount or amounts to be paid to the Contractor by reason of the total or partial termination of work pursuant to this clause, which amount or amounts may include a reasonable allowance for profit on work done; provided, that such agreed amount or amounts, exclusive of settlement costs, shall not exceed the total contract price as reduced by the amount of payments otherwise made and as further reduced by the contract price of work not terminated. The contract shall be amended accordingly, and the Contractor shall be paid the agreed amount. Nothing in paragraph E of this clause, prescribing the amount to be paid to the Contractor in the event of failure of the Contractor and the Contracting Officer to agree upon the whole amount to be paid to the Contractor by reason of the termination of work pursuant to this clause, shall be deemed to limit, restrict, or otherwise determine or affect the amount or amounts which may be agreed upon to be paid to the Contractor pursuant to this paragraph D.

E. In the event of the failure of the Contractor and the Contracting Officer to agree, as provided in paragraph D, upon the whole amount to be paid to the Contractor by reason of the termination of work pursuant to this clause, the Contracting Officer shall pay to the Contractor the amounts determined by the Contracting Officer as follows, but without duplication of any amounts agreed upon in accordance with paragraph D:

(1) With respect to all contract work performed prior to the effective date of the Notice of Termination, the total (without duplication of any items) of:

(a) the cost of such work;

(b) the cost of settling and paying claims arising out of the termination of work under subcontracts or orders as provided in paragraph B(5) above, exclusive of the amounts paid or payable on account of supplies or materials delivered or services furnished by the subcontractor prior to the effective date of the Notice of Termination of Work under this contract, which amounts shall be included in the cost on account of which payment is made under (A) above, and

(c) a sum, as profit on "a" above, determined by the Contracting Officer pursuant to 8-303 of the Armed Services Procurement Regulation, in effect as of the date of execution of this contract, to be fair and reasonable; provided, however, that if it appears that the Contractor would have sustained a loss on the entire contract had it been completed, no profit shall be included or allowed under this subdivision "c" and an appropriate adjustment shall be made reducing the amount of the settlement to reflect the indicated rate of loss; and

(2) The reasonable cost of the preservation and protection of property incurred pursuant to paragraph B(9); and any other reasonable cost incidental to termination of work under this contract, including expense incidental to the determination of the amount due to the Contractor as the result of the termination of work under this contract.

The total sum to be paid to the Contractor under (1) above shall not exceed the total contract price as reduced by the amount of payments otherwise made and as further reduced by the contract price of work not terminated. Except for normal spoilage, and except to the extent that the Owner shall have otherwise expressly assumed the risk of loss, there shall be excluded from the amounts payable to the Contractor under (1) above, the fair value, as determined by the Contracting Officer, of property which is destroyed, lost, stolen, or damaged so as to become undeliverable to the Owner, or to a buyer pursuant to paragraph B(7).

F. Costs claimed, agreed to, or determined pursuant to C, D, E, and I hereof shall be in accordance with Section XV of the Armed Services Procurement Regulation as in effect on the date of this contract.

G. The Contractor shall have the right of appeal, under the clause of this contract entitled "Disputes", from any determination made by the Contracting Officer under paragraph C, E, or I hereof, except that if the Contractor has failed to submit his claim within the time provided in paragraph C or I hereof, and has failed to request extension of such time, he shall have no such right of appeal. In any case where the Contracting Officer has made a determination of the amount due under paragraph C, E, or I hereof the Owner shall pay to the Contractor the following: (1) if there is no right of appeal hereunder or if no timely appeal has been taken, the amount so determined by the Contracting Officer, or (2) if an appeal has been taken, the amount finally determined on such appeal.

H. In arriving at the amount due the Contractor under this clause there shall be deducted (1) all unliquidated advance or other payments on account theretofore made to the Contractor, applicable to the terminated portion of this contract, (2) any claim which the Owner may have against the Contractor in connection with the contract, and (3) the agreed price for, or the proceeds of sale of any materials, supplies, or other things acquired by the Contractor or sold, pursuant to the provisions of this clause, and not otherwise recovered by or credited to the Owner.

I. If the termination hereunder be partial, the Contractor may file with the Contracting Officer a claim for an equitable adjustment of the price or prices specified in the contract relating to the continued portion of the contract (the portion not terminated by the Notice of Termination), and such equitable adjustment as may be agreed upon shall be made in such price or prices. Any claim by the Contractor for an equitable adjustment under this clause must be asserted within ninety (90) days from the effective date of the termination notice, unless an extension is granted in writing by the Contracting Officer.

J. The Owner may from time to time, under such terms and conditions as it may prescribe, make partial payments and payments on account against costs incurred by the Contractor in connection with the terminated portion of this contract whenever in the opinion of the Contracting Officer the aggregate of such payments shall be within the amount to which the Contractor will be entitled hereunder. If the total of such payments is in excess of the amount finally agreed or determined to be due under this clause, such excess shall be payable by the Contractor to the Owner upon demand, together with interest computed at the rate established by the Secretary of the Treasury pursuant to Public Law 92-41, 85 STAT 97 for the Renegotiation Board for the period from the date such excess payment is received by the Contractor to the date on which

such excess is repaid to the Owner; provided, however, that no interest shall be changed with respect to any such excess payment attributable to a reduction in the Contractor's claim by reason of retention or other disposition of termination inventory until ten days after the date of such retention or disposition, or such later date as determined by the Contracting Officer by reason of the circumstances.

K. Unless otherwise provided for in this contract, or by applicable statute, the Contractor shall--from the effective date of termination until the expiration of three years after final settlement under this contract--preserve and make available to the Owner at all reasonable times at the office of the Contractor but without direct charge to the Owner, all his books, records, documents and other evidence bearing on the costs and expenses of the Contractor under this contract and relating to the work terminated hereunder, or, to the extent approved by the Contracting Officer, photographs, microphotographs, or other authentic reproductions thereof.

78. USE OF UNITED STATES FLAG VESSELS

A. To use privately-owned United States flag commercial vessels to ship at least 50 percent of the gross tonnage (computed separately for dry bulk carriers, dry cargo lines, and tankers) of any equipment, materials, or commodities that are both (1) procured, contracted for, or otherwise obtained with funds made available by State under this contract, and (2) transported by ocean vessel, to the extent such vessels are available at fair and reasonable rates;

B. To furnish within 20 working days following the date of loading for shipments originating within the United States or within 30 working days following the date of loading for shipments originating outside the United States, a legible copy of a rated, "on-board" commercial ocean bill-of-lading in English for each shipment of cargo described in paragraph A above to both State and to the Division of National Cargo, Office of Market Development, U.S. Maritime Administration, Washington, D.C. 20590; and,

C. Subject to existing contracts, to insert the substance of the provisions of this section in all contracts issued pursuant to this contract, and to cause such provisions to be inserted in all subcontracts issued pursuant to this contract, where the contract or subcontract is for $100,000 or more and where there is a possibility of ocean transportation of procured equipment or materials.

79. DEBARMENT AND SUSPENSION

A. Contractor/Vendor shall not make any award or permit any award (subgrant or contract) at any tier to any party which is debarred or suspended or is otherwise excluded from or ineligible for participation in Federal assistance programs under Executive Order 12549, "Debarment and Suspension."

B. The Final Rule, Government-Wide Debarment and Suspension (Nonprocurement), issued by the Office of Management and Budget and the Department of Defense (32 CFR Part 25) to implement the provisions of Executive Order 12549, "Debarment and Suspension" is incorporated by reference and the Contractor/Vendor covenants and agrees to comply with all provisions thereof, including any amendments to the Final Rule that may hereafter be issued.

80. NONDISCRIMINATION

A. The Contractor/Vendor covenants and agrees that no person shall be denied benefits of, or otherwise be subjected to discrimination in connection with the Contractor/Vendor's performance under this MCA, on the ground of race, religion, color, national origin, sex or handicap. Accordingly and to the extent applicable, the Contractor/Vendor covenants and agrees to comply with the following:

(1) Title VII of the Civil Rights Act of 1964 (42 U.S.C. 2000d et seq.), and DOD Regulations (32 CFR Part 300) issued thereunder;

(2) Executive Order 11246 and Department of Labor Regulations issued thereunder (41 CFR Part 60);

(3) Section 504 of the Rehabilitation Act of 1973 (29 U.S.C. 794) and DOD Regulations issued thereunder (32 CFR Part 56); and,

(4) The Age Discrimination Act of 1975 (42 U.S.C. 6101 et seq.) and DOD Regulations issued thereunder (45 CFR Part 90).

81. LOBBYING

A. The Contractor/Vendor covenants and agrees that it will not expend any funds appropriated by Congress to pay any person for influencing or attempting to influence an officer or employee of any agency, or a Member of Congress in connection with any of the following covered Federal actions: the awarding of any Federal contract; the making of any Federal grant; the making of any Federal loan; the entering into of any cooperative agreement; and, the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

B. The Interim Final Rule, New Restrictions on Lobbying, issued by the Office of Management and Budget and the Department of Defense (32 CFR Part 28) to implement the provisions of Section 319 of Public Law 101-121 (31 U.S.C. 1352) is incorporated by reference.

82. DRUG-FREE WORK PLACE

A. The Contractor/Vendor covenants and agrees that it will comply with the provisions of the Drug-Free Work Place Act of 1988 (Public Law 100-690, Title V, Subtitle D; 41 U.S.C. 701 et seq.) and maintain a drug-free workplace.

B. The Final Rule, Government-Wide Requirements for Drug-Free Workplace (Grants), issued by the Office of Management and Budget and the Department of Defense (32 CFR Part 28, Subpart f) to implement the provisions of the Drug-Free Work Place Act of 1988 is incorporated by reference and the Contractor/Vendor covenants and agrees to comply with all the provisions thereof, including any amendments to the Final Rule that may hereafter be issued.

83. ENVIRONMENTAL STANDARDS

A. The Contractor/Vendor agrees that its performance under this contract shall comply with: the requirements of Section 114 of the Clean Air Act (42 U.S.C. § 7414) and Section 308 of the Federal Water Pollution Control Act (33 U.S.C. § 1318), that relate generally to inspection, monitoring, entry reports, and information, and with all regulations and guidelines issued thereunder; the Resources Conservation and Recovery Act (RCRA); the Comprehensive Environmental Response, Compensation and Liabilities Act (CERCLA); the National Environmental Policy Act (NEPA); and any applicable Federal, Contractor/Vendor or Local environmental regulation.

B. The Contractor/Vendor shall insure that no facility used in its performance under this contract is listed on the Environmental Protection Agency (EPA) list of violating facilities pursuant to 40 CFR Part 15 without the concurrence of State. The Contractor/Vendor shall notify State of the receipt of any communication from EPA indicating that a facility to be or being used in its performance under this contract is under consideration for listing on the EPA list of violating facilities.

C. For the purposes of this section, State agrees that the Contractor/Vendor's obligations in Paragraphs a. and b. of this section above shall not apply to any armory, base, training site, or other facility or portion thereof, the operation and maintenance of which is funded under this contract, that is currently listed as a violating facility, on the effective date of this contract, pursuant to 40 CFR Part 15; nor, shall such listing be the basis for State's termination for cause of this contract or for State's disallowance of any cost otherwise allowable under this contract. The Contractor/Vendor and State agree to cooperate to remediate, as expeditiously as possible, for any facility the operation and maintenance of which is within the scope of this contract, the condition giving rise to the listing of any such facility as a violating facility according to applicable statutes, regulations, or other agreements subject to the availability of funds.

84. NATIONAL HISTORIC PRESERVATION

Any construction, acquisition, modernization, or other activity that may impact a historic property.

A. The Contractor/Vendor agree to identify to the awarding agency any property listed or eligible for listing on the National Register of Historic Places that will be affected by this award, and to provide any help the awarding agency may need, with respect to this award, to comply with Section 106 of the National Historic Preservation Act of 1966 (16 U.S.C. 470, et seq.), as implemented by the Advisory Council on Historic Preservation regulations at 36 CFR Part 800 and Executive Order 11593 (3 CFR, 1971-1975 Comp., p. 559).

36 CFR Part 800 requires Grants Officers to get comments from the Advisory Council on Historic Preservation before proceeding with Federally assisted projects that may affect properties listed on or eligible for listing on the National Register of Historic Places.

85. HATCH ACT

A. The Contractor/Vendor agrees to comply with the Hatch Act (5 U.S.C. 1501 - 1508 and 7324 - 7328), as implemented by the Office of Personnel Management at 5 CFR Part 151, which limits political activity of employees or officers of State or local governments whose employment is connected to an activity financed in whole or part with Federal funds.

86. CARGO PREFERENCE

Any agreement under which international air travel may be supported by U.S. Government funds.

A. Travel supported by U.S. Government funds under this agreement shall use U.S.-flag air carriers (air carriers holding certificates under 49 U.S.C. 41102) for international air transportation of people and property to the extent that such service is available, in accordance with the International Air Transportation Fair Competitive Practices Act of 1974 (49 U.S.C. 40118) and the interpretative guidelines issued by the Comptroller General of the United States in the March 31, 1981, amendment to Comptroller General Decision B138942.

87. RELOCATION AND REAL PROPERTY ACQUISITION

A. The Contractor/Vendor agrees that it will comply with the provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (42 U.S.C. § 4601 et seq.) and regulations issued thereunder (49 CFR Part 24).

88. CONTRACT WORK HOURS AND SAFETY STANDARDS ACT

A. The Contractor/Vendor agrees that it will comply with Sections 103 and 107 of the Contract Work Hours and Safety Standards (40 U.S.C. 327-330) as supplemented by Department of Labor regulations (29 CFR Part 5). As applied to this agreement, the Contract Work Hours and Safety Standards Act specifies that no laborer or mechanic doing any part of the work contemplated by this agreement shall be required or permitted to work more than 40 hours in any workweek unless paid for all additional hours at not less than 1 1/2 times the basic rate of pay. This Act is applicable to any construction contract awarded in excess of $2,000, and in excess of $2,500 for other contracts which involve the employment of mechanics or laborers.

89. DAVIS-BACON ACT

When required by Federal assistance program legislation, such as the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended, environmental remediation construction, the following provision applies.

A. The Contractor/Vendor agrees that it will comply with the Davis-Bacon Act (40 U.S.C. 276a to a-7) as supplemented by U.S. Department of Labor regulations (29 CFR Part 5). All rulings and interpretations of the Davis-Bacon Acts contained in 29 CFR Part 5 are incorporated by reference in this agreement. As applied to this agreement, the Davis-Bacon Act (40 U.S.C. 276a-276a-7) provides that contracts in excess of $2,000 to which the Federal Government provides assistance funding for construction, alteration, or repair (including painting and decorating) of public buildings or public works within the United States, shall contain a provision that no laborer or mechanic employed directly upon the site of the work shall receive less than the prevailing wage rates as determined by the U.S. Secretary of Labor.

90. STATE ADDENDUM

A. “It is agreed that the terms and commitments contained herein shall not constitute a debt of The State of Alabama in violation of Article II, Section 213 of the Constitution of Alabama, 1901, as amended by Amendment 26. It is further agreed that if any provision of this contract shall contravene any statue, constitutional provision or amendment to the Constitution, now in effect or which may, during the course of this contract be enacted. Then that conflicting provision in the contract shall be deemed null and void.”

B. “The Contractor’s sole remedy for settlement or any and all disputes arising under the Terms of this agreement shall be limited to filing a claim with The Board of Adjustment for the State of Alabama.”

C. “In event of proration of the fund from which payment under this contract is to be made; the contract will be subject to termination.”

D. “The Contractor acknowledges and understands this contract is not effective until it has received all requisite state government approvals and the Contractor shall not begin performance until notified to do so by State Property & Disbursing Office. The Contractor shall not be entitled to compensation for work performed prior to effective date of contract.”

SECTION 00 73 00 - SPECIAL CONDITIONS OF THE CONTRACT

The following special conditions modify, change, delete, or add to the "General Conditions of the Contract", (June 2009) Section 00 72 00. Where any Article, Paragraph, or Clause of the General Conditions is modified or deleted by the Special Conditions, the unaltered provisions of that Article, Paragraph, or Clause remain in effect. These Special Conditions shall take precedence over and modify all other specification provisions to the extent in which there may be any conflict.

PARAGRAPH 2. DEFINITIONS, INTENT, CORRELATION, AND STREAMLINING

2.C(1) Modify the "Order of Precedence" as follows:

(a) The Contract Agreement

(b) Addenda, with those of later date having precedence over those of earlier date.

(c) Special Conditions (or other Conditions which modify the General Conditions of the Contract).

(d) General Conditions of the Contract

(e) The Detailed Specification Requirements

(f) Details appearing on the Drawings; large scale details shall take precedence over smaller scale details.

(g) The Working Drawings; large scale drawings shall take precedence over smaller scale drawings.

2.C(5) Add the following:

In the case of inconsistency between Drawings and Specifications or within either document not clarified by addendum, the better quality or greater quantity of Work shall be provided in accordance with the Architect's interpretation.

PARAGRAPH 14. PROTECTION OF WORK AND PROPERTY

Add the following:

This project location/site is normally used as a U. S. Military facility.

If U. S. Military personnel are remaining in tenancy, the Contractor shall be required, for the duration of the project, to maintain the level of security that exists at the project site at the Notice to Proceed date. The Contractor shall make certain that at the end of each workday all doors, windows, walls penetrations, fencing, etc. is completely secured to prevent intruders, etc. In the event that the facility cannot be secured via Owner approved: locks, temporary partitions, etc. then the Contractor shall provide at his expense, a qualified security guard (pre-approved in writing by the Owner) to protect the site or building. Failure to maintain the security of the facility can be considered grounds for dismissal from the project.

For facilities where U. S. Military personnel are remaining in tenancy, the general operating hours of this facility are approximately 7:00 a.m. to 5:30 p.m. Tuesday - Friday. In the event that the Contractor must conduct work outside of the typical operating hours of the facility the Contractor must notify and request in writing to the Owner and Architect a minimum of five days prior to the time that Contractor desires to work. The Contractor shall not work outside typical operating hours unless it is approved, in writing, by the Owner.

The provisions in the previous two paragraphs can be modified by the Owner. These provisions may also be modified by Addenda.

The Contractor shall not permit a load to be applied, or forces introduced, to any part of the existing or new construction or site that may cause damage to the construction or site or endanger safety of the construction, site, or persons on or near the site.

PARAGRAPH 19. CHANGES IN THE WORK

Modify per the following:

A. By mutually agreed price or prices which will be added to or deducted from the Contract Price. Additions to the contract price shall include the Contractor's overhead and profit but shall not exceed 15 percent. Where subcontract work is involved, the total mark-up for the Contractor and subcontractors shall not exceed 25%. This percentage allowance for overhead and profit shall include the cost of superintendent, timekeeper, clerks, watchmen, use of small tools, incidental job burdens, and general office expenses. There will be no additional or separate charges for these items. ~~No allowance for overhead and profit shall be figured on any change which involves a net credit to the Owner.~~ Changes which involve a net credit to the Owner shall include credits for overhead and profit on the deducted work.

PARAGRAPH 28. APPLICATIONS FOR PARTIAL AND FINAL PAYMENTS

Add the following:

Unless otherwise provided in the Contract Documents, the Contractor's cost of materials and equipment to be incorporated into the Work, which are stored off site, may also be considered in Partial Applications for Payment under the following conditions:

(1) the contractor has received written approval from the Owner to store the materials or equipment off site in advance of delivering materials to the off-site location;

(2) a Certificate of Insurance is furnished to, and accepted by, the Owner evidencing that a special insurance policy, or rider to an existing policy, has been obtained by the Contractor providing all-risk property insurance coverage, specifically naming the materials or equipment stored and naming the Owner as an additionally insured party;

(3) the Architect is provided with a detailed inventory of stored materials or equipment and the materials or equipment are clearly marked in correlation to the inventory to facilitate inspection and verification of the presence of the materials or equipment by the Architect or Owner;

(4) the materials or equipment are properly and safely stored in a bonded warehouse, or a facility otherwise approved in advance by the Owner; and

(5) compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest.

FINAL ACCEPTANCE of the WORK

Final Completion or Final Acceptance of the Work shall be achieved when all work including all "punch list" items recorded have been fully completed or corrected and accepted by the Owner and Architect.

PREREQUISITES to FINAL PAYMENT

The following conditions are prerequisites to Final Payment becoming due to the Contractor:

(1) Full execution of the Certificate of Final Completion for the Work.

(2) The Contractor's completion, to the satisfaction of the Architect and Owner, of all documentary requirements identified in sections 01 77 00 - Project Closeout and 01 78 13 Project Closeout Checklist.

PARAGRAPH 89. DAVIS BACON ACT

Delete this paragraph in its entirety.

ADD THE FOLLOWING PARAGRAPH:

PARAGRAPH 91. ADDITIONAL GENERAL CONTRACTOR ONE YEAR WARRANTY ITEMS

1. The General Contractor is required to provide the Manufacturer's recommended preventative maintenance, including inspections, for ALL items installed or refurbished in this project for a period of ONE year from the date of final acceptance.

2. The General Contractor will perform the preventative maintenance and inspections per Manufacturer's recommended intervals for each item.

3. The General Contractor will provide the Owner written documentation that the required preventative maintenance and inspections have been performed. This documentation will be provided at each Manufacturer's recommended interval and verified by the owner or tenant of each facility.

END OF SECTION

SECTION 01 10 00 - SUMMARY OF WORK

(Revision Date: 17 August 2021)

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work in this section.

1.02 WORK COVERED BY CONTRACT DOCUMENTS

A. The Project consists of work as described in the drawings and specifications entitled: **PELHAM RENAMING EFFORT, FORT MCCLELLAN, ALABAMA** prepared by **JMR+H ARCHITECTURE P.C.**, dated 9 AUGUST 2023.

BID ITEM A :	MONUMENT SIGN
BID ITEM B:	BUILDING 1026 CONSTRUCTION
BID ITEM C:	DEMOLITION OF EXISTING BUILDING 1026

B. The types of work specified in this section include the following:
   1. Furnishing of all labor, materials, tools, equipment, staging areas, hoisting, qualified personnel and proper supervision for the work described in the drawings and specifications.
   2. Protection of the buildings, grounds, building personnel and visitors.

C. Work to be performed under a single prime contract.

1.03 WORK UNDER OTHER CONTRACTS

A. The Owner may at times have other work in progress at the site.

B. Contractor shall cooperate fully with separate contractors (if any) so that work under those contracts may be carried out smoothly, without interfering with or delaying work under either contract.

1.04 CONTRACTOR USE OF PREMISES

A. General: During the construction period the Contractor shall have access to all areas of the building where work is to be undertaken.

B. OWNER OCCUPANCY
   1. Reference Section 00 73 00 – Special Conditions of the Contract, Paragraph 14.

1.05 JOB CONDITIONS

A. Coordinate all work under this contract with interfacing and adjoining work for proper sequencing of each installation. Ensure best possible weather resistance and durability of the work and protection of materials and finishes.

B. The Contractor is responsible for the water tightness of the Existing Building during the construction contract period (after work of this contract begins). In the event the Contractor fails to maintain buildings in a watertight condition, the Contractor shall be responsible for any damage caused to the Owner's property.

C. In the event emergency action must be taken by the Owner's maintenance forces to protect property, due to the Contractor’s failure to maintain buildings in a watertight condition, the Contractor shall be responsible for all of the Owners' labor and materials cost incurred due to emergency action and he shall reimburse the Owner for such cost by standard Change Order procedure.

D. Work under this contract must be completed in a continuous fashion. If the Contract Documents show phased work, the phasing plan must be followed, unless the Contractor has requested, and received, written approval from the Owner to deviate from the phasing plan shown in the Contract Documents.

E. CONTRACTOR USE OF SITE AND PREMISES
   1. Provide access to and from site as required by law and by Owner:

a. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
b. Do not obstruct roadways, sidewalks, or other public ways without permit.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 WORK SEQUENCE

A. The Notice to Proceed (NTP) is **14** calendar days from the email delivery of the fully executed contract to the Contractor, unless otherwise agreed upon, in writing, by the Owner and the Contractor.

B. Contract Time begins at the NTP.

C. Perform all work in not to exceed **250 Calendar Days** in accordance with the following (calculated as the sum of 3.01.C.1 through 3.01.C.2. [inclusive]):
   1. The Contractor has **205 Calendar Days** to perform all Work, including but not limited to the following: providing all required operator training, the “Punch-List Inspection”, correcting all deficiencies noted in the “Punch-List Inspection”, and successful completion of the Final Inspection – with no noted deficiencies.
   2. The Contractor has **45** days, from 3.01.C.1. (above), to have submitted a complete Project Closeout package, as detailed and defined in Sections 01 77 00 and 01 78 13.

3.02 LIQUIDATED DAMAGES

A. If final completion is not achieved within the time for contraction noted above, liquidated damages will be assessed in the amount of 6% per annum.

B. The liquidated damages assessed will be deducted from the final pay application prior to payment by the Owner.

END OF SECTION

SECTION 01 23 00 - ALTERNATES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Administrative and procedural requirements for Additive Alternates.

1.02 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added to or deducted from the Base Bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.03 PROCEDURES

A. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.

1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.

B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to alternates.

C. Execute accepted alternates under the same conditions as other work of the Contract.

D. Schedule: A Schedule of Alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 SCHEDULE OF ALTERNATES

A. Bid Item A Alternate No. 1:

Each bidder shall include on their proposal an Alternate price including all labor, material, taxes, overhead, profit, etc. for the demolition of the former Guard Shack.

B. Bid Item B, Alternate No. 1:

Each bidder shall include on their proposal an Alternate price including all labor, material, taxes, overhead, profit, etc. to add 2”asphalt wearing surface over the crushed stone base at the drive and parking.

END OF SECTION

SECTION 01 25 13 - PRODUCT SUBSTITUTION PROCEDURES

PART 1 - GENERAL:

1.01 SUMMARY

A. Section Includes: Administrative and procedural requirements for handling requests for substitutions made AFTER award of the Contract.

B. Related Sections:
1. 00 43 25 - Substitution Request Form During Bidding.
2. 00 72 00 - General Conditions of the Contract
3. 01 25 14 - Substitution Request Form During Construction.
4. 01 33 00 - Submittal Procedures

1.02 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

1.03 SUBMITTALS

A. Substitution Request Form: Submit all substitution requests using the form provided in this Project Manual. Use Section 01 25 14 - Substitution Request Form During Construction.
1. Product substitutions will NOT be considered after award of the Contract unless the above substitution form is used.
2. Architect will reject incomplete forms.

B. Substitution Requests: Submit three (3) copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number(s), Specification Section title(s), Drawing number(s), and Drawing title(s).
1. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
a. Statement indicating why specified material or product cannot be provided.
b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
e. Samples, where applicable or requested.
f. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
g. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
h. Research/evaluation reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to the Owner.
i. Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.
j. Cost information, including a proposal of change, if any, in the Contract Sum.
k. Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.
l. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven (7) days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution.

PART 2 - PRODUCTS

2.01 PRODUCT SUBSTITUTIONS

A. Timing: Architect will consider requests for substitution if received within twenty (20) days after Notice to Proceed. Requests received after that time may be considered or rejected at discretion of Architect.

B. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
   1. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
   2. Requested substitution does not require extensive revisions to the Contract Documents.
   3. Requested substitution is consistent with the Contract Documents and will produce indicated results.
   4. Substitution request is fully documented and properly submitted.
   5. Requested substitution will not adversely affect Contractor's Construction Schedule.
   6. Requested substitution has received necessary approvals of authorities having jurisdiction.
   7. Requested substitution is compatible with other portions of the Work.
   8. Requested substitution has been coordinated with other portions of the Work.
   9. Requested substitution provides specified warranty.
   10. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

C. Exceptions: The following are not considered substitutions and are not subject to requirements specified in this Section:
   1. Substitutions requested during the Bidding period, and accepted via Addenda.
   2. Revisions to Contract Documents requested by the Owner.
   3. Specified options on products and construction methods included in Contract Documents.

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 25 14 - SUBSTITUTION REQUEST FORM DURING CONSTRUCTION

(CONTRACTOR SHALL USE THIS FORM FOR SUBMITTING SUBSTITUTION REQUEST AFTER AWARD OF CONTRACT. OTHER FORMS OF SUBSTITUTION REQUESTS WILL NOT BE CONSIDERED.)

Project: PELHAM RENAMING EFFORT **Substitution Request Number: _____**
FORT MCCLELLAN, ALABAMA
IFB No. AC-23-B-0016-S

Architect: JMR+H Architecture, PC
445 Dexter Avenue, Suite 5050
Montgomery, Alabama 36104

From: _____

Re : _____

Specification Title : _____ Section: _____

Description : _____ Page : _____ Article/Paragraph: _____

Proposed Substitution:
_____

Manufacturer: _____ Address: _____ Phone: _____

Trade Name: _____ Model No.: _____

Installer: _____ Address: _____ Phone: _____

History: New Product 1 – 4 years old 5 – 10 years old Exceeds 10 years old

Differences between proposed substitution and specified product: _____
_____
_____
_____

Point by Point comparative data attached – REQUIRED BY ARCHITECT

Reason for not providing specified item: _____
_____
_____
_____

Similar Installation:

Project: _____ Architect: _____

Address: _____ Owner: _____

_____Date Installed: _____

Proposed substitution affects other parts of Work: ___ No ___ Yes:
Explain_____
_____
_____

Savings to Owner for accepting substitution: _____ ($ _____)

Proposed substitution changes Contract Time: ___No ___ Yes [Add] [Deduct] _____ days.

NOTE: Acceptance of substitution request by the Architect will require the Contractor to submit a change order request in accordance with the General Conditions of the Contract. Should the Owner reject the change order request, the Substitution Request is therefore rejected, and the Contractor must comply with the requirements of the Contract Documents as if the request was rejected by the Architect.

Supporting Data Attached:

Drawings Product Data Samples Tests Reports _____

The Undersigned Certifies:

Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product. Same warranty will be furnished for proposed substitution as for specified product. Same maintenance service and source of replacement parts, as applicable, is available. Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule. Cost data as stated above is complete. Claims for additional costs related to accepted substitution which may subsequently become apparent are to be waived. Proposed substitution does not affect dimensions and functional clearances. Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution. Coordination, installation, and changes in the Work as necessary for accepted substitution will be complete in all respects.

Submitted By: _____ Signed By: _____

Firm:

_____

Address:

_____

_____

Telephone: _____ Fax: _____

E-mail: _____ Website: _____

Attachments:

_____

_____

A/E's REVIEW AND ACTION (to be filled-in by Architect/Engineer)

Substitution Approved

Substitution Approved as Noted

Substitution Rejected

Substitution Request Received Too Late

Signed By: _____ Date: _____

Additional Comments:

Contractor **Subcontractor** **Supplier** **Manufacturer** **A/E**

END OF SECTION

SECTION 01 26 00 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section specifies administrative and procedural requirements for handling and processing Contract modifications.

B. Related Sections include the following:

1. Specification 00 72 00 General Conditions of the Contract, Specification 00 73 00 Special Conditions of the Contract and Specification 01 26 14 Change Order Recap Form.

1.03 MINOR CHANGES IN THE WORK

A. All changes in the Work will only be authorized by a fully executed Contract Modification Form, executed by both the Contractor and the Owner, or as otherwise authorized by the General Conditions of the Contract.

1.04 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Owner will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.

1. Proposal Requests issued by Owner are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.
2. Within time specified in Proposal Request after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change. The submission shall include:
   a. A list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
   b. Indication of applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
   c. Costs of labor directly attributable to the change.
   d. An updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
   e. Other requirements of the General Conditions of the Contract.
   f. Change Order Request Recap Form (01 26 14) completed by the Contractor.
   g. Submission will be made as one complete packet, via electronic mail, to the Architect.

B. Contractor-Initiated Proposals: If latent or unforeseen conditions require modifications to the Contract, Contractor may propose changes by submitting a request for a change to Architect.

1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time. The submission shall include:
   a. A list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
   b. Indication of applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
   c. Costs of labor directly attributable to the change.
   d. An updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

e. Other requirements of the General Conditions of the Contract.
f. Change Order Request Recap Form (01 26 14) completed by the Contractor.
g. Submission will be made as one complete packet, via electronic mail, to the Architect.

C. Proposal Request Form: Request for Proposal will be on Owner's approved form.

1.05 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Proposal Request, the Owner will issue a Contract Modification for signatures of Owner, Surety and Contractor on Owner's "Contract Modification / Supplemental Agreement Form".

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

01 26 14 CHANGE ORDER RECAP FORM

Change Proposal Recap Sheet

Date: _____
Contractor Name: _____
Project Name: _____
Contract Number : _____
Reference RFP or RFI Number: _____

Initiated By: (Check One)
Owner/Architect
Contractor
Subcontractor

Brief Description of Proposed Change: _____

GENERAL CONTRACTOR Direct Cost Summary

Item/Description *	Quantity	Unit	Amount					
			Unit $	Material	Unit $	Labor	Unit $	Equipment
				$0.00		$0.00		$0.00
				$0.00		$0.00		$0.00
				$0.00		$0.00		$0.00
				$0.00		$0.00		$0.00
				$0.00		$0.00		$0.00
				$0.00		$0.00		$0.00
				$0.00		$0.00		$0.00
				$0.00		$0.00		$0.00
				$0.00		$0.00		$0.00
			Sub Totals	$0.00		$0.00		$0.00

Material:	$0.00
Labor:	$0.00
Equipment:	$0.00
Prime Contractor Subtotal:	$0.00

SUBCONTRACTOR Direct Cost Summary

Item/Description *	Quantity	Unit	Amount							
			Unit $	Material	Unit $	Labor	Unit $	Equipment	Unit $	Sub-sub
				$0.00		$0.00		$0.00		$0.00
				$0.00		$0.00		$0.00		$0.00
				$0.00		$0.00		$0.00		$0.00
				$0.00		$0.00		$0.00		$0.00
				$0.00		$0.00		$0.00		$0.00
				$0.00		$0.00		$0.00		$0.00
				$0.00		$0.00		$0.00		$0.00
				$0.00		$0.00		$0.00		$0.00
			Sub Totals	$0.00		$0.00		$0.00		$0.00

Material:	$0.00
Labor:	$0.00
Equipment:	$0.00
Sub-sub	$0.00
Subcontractors Subtotal:	$0.00

Mark-up Calculations

Subcontractors Subtotal:	$0.00	
Prime Cntrtr Subtotal:	$0.00	
Total Direct Cost:	$0.00	
GC OH&P on Own Work:	$0.00	15%
Total OH&P on Sub Work:	$0.00	25%

Total Cost Change _____ Add / Deduct
$0.00

Total Time Change **0** Calendar Days (Critical path impacts only)

* Materials permanently installed in the building shall be sales tax free.
* Any requests for additional time are only considered if the critical path of the project is extended. Attach additional pages with explanation of how the change affects the critical path of the project.

Armory Commission of Alabama

REQUEST FOR INFORMATION FORM

CONTRACTOR:

PROJECT:
PELHAM RENAMING EFFORT
FORT MCCLELLAN, ALABAMA

RFI#:

DATE:

TO / ATTN:

FROM:

DESCRIPTION:

DRAWING NUMBER:

SPEC SECTION:

DESCRIPTION OF RFI:

RECOMMENDED SOLUTION BY GC:

SIGNATURE:

SCHEDULE IMPACT: ☐YES ☐ NO ☐UNKNOWN **RESPONSE REQUIRED:** ☐YES ☐ NO

COST IMPACT: ☐YES ☐ NO ☐UNKNOWN

RECOMMENDATION OR RESPONSE:

SIGNATURE:

DATE:

SECTION 01 29 00 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section specifies administrative and procedural requirements necessary to prepare and process Applications for Payment.

B. Related Sections include the following:
   1. Section 01 31 00 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
   2. Section 01 32 00 "Construction Progress Documentation" for administrative requirements governing preparation and submittal of Contractor's Construction Schedule and Submittals Schedule.
   3. Section 00 62 76 “Contractor’s Periodical Request for Partial Payment”

1.03 DEFINITIONS

A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.04 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the Schedule of Values with preparation of Contractor's Construction Schedule.
   1. Correlate line items in the Schedule of Values with other required administrative forms and schedules, including the following:
      a. Application for Payment forms with Continuation Sheets.
      b. Submittals Schedule.
      c. Contractor's Construction Schedule.
   2. Submit the Schedule of Values to Architect in accordance with the requirements of the requirements of the Addenda and concurrent with both the initial Contractor’s Draw Schedule (Section 00 62 83) and Contractor’s Progress Schedule (Section 01 32 00).

B. Format and Content: Use the Project Manual table of contents as a guide to establish line items for the Schedule of Values. Provide at least one line item for each Specification Section.
   1. Identification: Utilize the Contractor’s Periodical Request for Partial Payment form at Specification 00 62 83 for the Schedule of Values.
   2. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Provide several line items for principal subcontract amounts, where appropriate or as directed by the Owner.
   3. To the greatest extent possible, round amounts to nearest whole dollar; total shall equal the Contract sum.
   4. Provide a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
      a. Differentiate between items stored on-site and items stored off-site per 00 62 78.
   5. Provide separate line items in the Schedule of Values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
   6. Allowances: Provide a separate line item in the Schedule of Values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by the allowance quantity. Use information indicated in the Contract Documents to determine quantities.
   7. Alternates: Provide a separate line item in the Schedule of Values for each alternate.
   8. There shall be a separate line in the amount of 2.5% of the Contract, as awarded, included on the Schedule of Values and titled “Closeout Documents”

9. Each item in the Schedule of Values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
    a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the Schedule of Values or distributed as general overhead expense, at Contractor's option.

1.05 APPLICATIONS FOR PAYMENT

A. Each Application for Payment shall be consistent with previous applications and payments as checked by Architect and paid for by Owner.
    1. Initial Application for Payment, Application for Payment at time of Completion, and Final Application for Payment involve additional requirements.

B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction Work covered by each Application for Payment is the period indicated in the Agreement.

C. Payment Application Forms: Use Owner provided “Contractor’s Periodical Request for Partial Payment” and Continuation Sheets as form for Applications for Payment.

D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. NOTE: If the Application is not signed by the person who submitted the Bid, the Architect and/or Owner reserve the right to reject the Application, unless and until the Contractor shall have provided the Owner a letter authorizing additional signatories, on Contractor’s letterhead, and that Owner has accepted. Architect will return incomplete applications without action.
    1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions were made.
    2. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

E. Transmittal: Submit three, signed in blue ink and notarized, original copies of each Application for Payment to Architect at the next Owner-Architect-Contractor (OAC) meeting. Include waivers of lien and similar attachments as required.
    1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

F. Initial Application for Payment: Administrative actions and submittals, to include Owner’s acceptance, that must precede submittal of first Application for Payment include the following:
    1. List of subcontractors.
    2. Schedule of Values.
    3. Contractor's Construction Schedule.
    4. Submittals Schedule (preliminary if not final).
    5. List of Contractor's principal consultants.
    6. Initial settlement survey and damage report if required.

G. Periodic Applications for Payment: Administrative actions and submittals that must coincide with submittal of each Application for Payment include the following:
    1. Contractor’s Periodical Request for Partial Payment.
    2. Submittals Schedule (updated).
    3. Inventory of Stored Materials - submitted on form provided in Specification Section 00 62 78.
    4. Contractor’s Draw Schedule on form provided in Specification Section 00 62 83.
    5. Weather Delay Documentation Form as provided in Specification Section 00 63 56.
    6. Updated LEED Scorecard (if Applicable)

H. Final Payment Application: Submit final Application for Payment with releases and supporting documentation showing 100 percent completion for portion of the Work claimed as complete, including, but not limited, to the following:
    1. Evidence of completion of Project closeout requirements.
    2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
    3. Updated final statement, accounting for final changes to the Contract Sum.
    4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."

5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
6. AIA Document G707, "Consent of Surety to Final Payment."
7. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Final Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
8. Final, liquidated damages settlement statement.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
   1. Coordination Drawings.
   2. Administrative and supervisory personnel.
   3. Project meetings.

B. Related Sections:
   1. Section 01 32 00 - Construction Progress Documentation: Preparing and submitting Contractor's Construction Schedule.
   2. Section 01 73 00 - Execution: Procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
   3. Section 01 77 00 - Closeout Procedures: Coordinating Contract closeout.

1.02 COORDINATION

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.
   1. Schedule construction operations in the sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
   2. Coordinate installation of different components to assure manufacturers and applicable code(s) [whichever is greater] accessibility for required maintenance, service, and repair.
   3. Make provisions to accommodate items scheduled for later installation.

B. Where necessary, prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and attendance at meetings.
   1. Prepare similar memoranda for the Owner and separate contractors where coordination of their work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
   1. Preparation of Contractor's Construction Schedule.
   2. Preparation of the Schedule of Values.
   3. Installation and removal of temporary facilities and controls.
   4. Delivery and processing of submittals.
   5. Progress meetings.
   6. Pre-installation conferences.
   7. Project closeout activities.

D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.
   1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. Refer to other Sections for disposition of salvaged materials that are designated as Owner's property.

1.03 SUBMITTALS

A. Coordination Drawings: Prepare Coordination Drawings if limited space availability necessitates maximum utilization of space for efficient installation of different components or if coordination is required for installation of products and materials fabricated by separate entities.
   1. Content: Project-specific information, drawn accurately to scale. Do not base Coordination Drawings on reproductions of the Contract Documents or standard printed data. Include the following information, as applicable:

a. Indicate functional and spatial relationships of components of architectural, structural, civil/site, mechanical, plumbing, and electrical systems.
b. Indicate dimensions shown on the Contract Drawings and make specific note of dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect for resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

2. Sheet Size: At least 8-1/2 by 11 inches but no larger than 30 by 40 inches.
3. Number of Copies: Submit two opaque copies of each submittal. Architect will return one copy.
4. Refer to individual Sections for Coordination Drawing requirements for Work in those Sections.

B. Staff Names: Within 15 days of commencement of construction operations, submit a list of the Contractor's principal staff assignments, including the superintendent and other personnel in attendance at the Project Site. Identify individuals and their duties and responsibilities. List their addresses and telephone numbers.
1. Post copies of the list in the Project meeting room, the temporary field office, and each temporary telephone.

1.04 PROJECT MEETINGS

A. General: Architect will schedule and conduct meetings and conferences at Project site, unless otherwise indicated.
1. Attendees: Architect will inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Architect will notify Owner and Contractor of scheduled meeting dates and times.
2. Agenda: Contractor will prepare and distribute the meeting agenda to all invited attendees.
a. Contractor shall provide Architect and Owner with agenda items 48 hours before the Project Meeting.
3. Minutes: Contractor will record significant discussions and agreements achieved. Meeting minutes will be distributed to everyone concerned, including Owner and Architect, within three (3) days of the meeting.

B. Preconstruction Conference: Owner will schedule a preconstruction conference before starting construction, at a time convenient to Architect and Contractor, after execution of the Agreement. Hold the conference at Project site or another convenient location. Conduct the meeting to review responsibilities and personnel assignments.
1. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Discuss items of significance that could affect progress, including the following:
a. Tentative construction schedule.
b. Phasing.
c. Critical work sequencing and long-lead items.
d. Designation of key personnel and their duties.
e. Procedures for processing Change Order Requests and Contract Modifications.
f. Procedures for requests for information (RFIs) utilizing the form in Section 01 26 20.
g. Procedures for testing and inspecting.
h. Procedures for processing Applications for Payment.
i. Distribution of the Contract Documents.
j. Submittal procedures.
k. LEED requirements (if applicable).
l. Preparation of Record Documents.
m. Use of the premises and existing building(s).
n. Work restrictions.
o. Owner's occupancy requirements.
p. Responsibility for temporary facilities and controls.

q. Construction waste management and recycling.
r. Parking availability.
s. Office, work, and storage areas.
t. Equipment deliveries and priorities.
u. First aid.
v. Security.
w. Progress cleaning.
x. Working hours.

3. Minutes: Architect will record and distribute meeting minutes.

C. Pre-installation Conferences: Conduct a pre-installation conference at Project site before each construction activity that requires coordination with other construction.
1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
a. The Contract Documents.
b. Options.
c. Related requests for interpretations (RFIs).
d. Related Change Orders.
e. Purchases.
f. Deliveries.
g. Submittals.
h. Review of mockups.
i. Possible conflicts.
j. Compatibility problems.
k. Time schedules.
l. Weather limitations.
m. Manufacturer's written recommendations.
n. Warranty requirements.
o. Compatibility of materials.
p. Acceptability of substrates.
q. Temporary facilities and controls.
r. Space and access limitations.
s. Regulations of authorities having jurisdiction.
t. Testing and inspecting requirements.
u. Installation procedures.
v. Coordination with other work.
w. Required performance results.
x. Protection of adjacent work.
y. Protection of construction and personnel.

3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Progress Meetings: Conduct progress meetings at regular intervals (at least monthly) scheduled with the Owner and Architect, otherwise known as Owner-Architect-Contractor (OAC) meetings. Coordinate dates of meetings with preparation of payment requests.
1. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.

2. Agenda: Review minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
   a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
      1) Review schedule for next period.
   b. Review present and future needs of each entity present, including the following:
      1) Interface requirements.
      2) Sequence of operations.
      3) Status of submittals.
      4) Deliveries.
      5) Off-site fabrication.
      6) Access.
      7) Site utilization.
      8) Temporary facilities and controls.
      9) Work hours.
      10) Hazards and risks.
      11) Progress cleaning.
      12) Quality and work standards.
      13) Status of correction of deficient items.
      14) Field observations.
      15) Requests for information (RFIs).
      16) Status of proposal requests.
      17) Pending Change Order Requests.
      18) Status of Contract Modifications.
      19) Pending claims and disputes.
      20) Review of executed Periodical Requests for Partial Payments.
3. Minutes: Contractor will record the meeting minutes.
4. Reporting: Not later than 3 days after each meeting, distribute minutes of the meeting to each party present and to parties who should have been present. Include a brief summary, in narrative form, of progress since the previous meeting and report.
   a. Schedule Updating: Update Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 32 00 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
   1. Contractor's Construction Schedule.
   2. Submittals Schedule.
   3. Daily construction reports.
   4. Field condition reports.

B. Related Sections:
   1. Section 012900 - Payment Procedures: Submitting the Schedule of Values.
   2. Section 013100 - Project Management and Coordination: Submitting and distributing meeting and conference minutes.
   3. Section 013300 - Submittal Procedures: Submitting schedules and reports.
   4. Section 014000 - Quality Assurance: Submitting a schedule of tests and inspections.

1.02 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
   1. Critical activities are activities on the critical path. They must start and finish on the planned early start and finish times.
   2. Predecessor Activity: An activity that precedes another activity in the network.
   3. Successor Activity: An activity that follows another activity in the network.

B. Fragment: A partial or fragmentary network that breaks down activities into smaller activities for greater detail.

C. Major Area: A story of construction, a separate building, or a similar significant construction element.

1.03 SUBMITTALS

A. Submittals Schedule: Submit three (3) copies of schedule. Arrange the following information in a tabular format:
   1. Scheduled date for first submittal.
   2. Specification Section number and title.
   3. Submittal category (action or informational).
   4. Name of subcontractor.
   5. Description of the Work covered.
   6. Scheduled date for Architect's final release or approval.

B. Field Condition Reports: Submit two (2) copies at time of discovery of differing conditions.

1.04 COORDINATION

A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.

B. Coordinate Contractor's Construction Schedule with the Schedule of Values (01 29 00) and Contractors Draw Schedule (00 62 83), list of subcontracts, Submittals Schedule, progress reports, payment requests, and other required schedules and reports.
   1. Secure time commitments for performing critical elements of the Work from parties involved.
   2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.01 SUBMITTALS SCHEDULE

A. Preparation: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, resubmittal, ordering, manufacturing, fabrication, and delivery when establishing dates.
   1. Coordinate Submittals Schedule with list of subcontracts, the Schedule of Values, and Contractor's Construction Schedule.
   2. Submit concurrently with the first complete submittal of Contractor's Construction Schedule.

2.02 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Time Frame: Extend schedule from date established for the NTP to date of Final Completion.
   1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

B. Activities: Treat each story or separate area as a separate numbered activity for each principal element of the Work. Comply with the following:
   1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Ownert.
   2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
   3. Submittal Review Time: Include review and resubmittal times indicated in Section 01 33 00 - Submittal Procedures in schedule. Coordinate submittal review times in Contractor's Construction Schedule with Submittals Schedule.
   4. Startup and Testing Time: Include not less than three (3) days for startup and testing.
   5. Project Completion: Indicate completion in advance of date established for Project Completion, and allow time for Architect's administrative procedures necessary for certification of Project Completion.

C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
   1. Phasing: Arrange list of activities on schedule by phase.
   2. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
   3. Work Restrictions: Show the effect of the following items on the schedule:
      a. Coordination with existing construction.
      b. Limitations of continued occupancies.
      c. Uninterruptible services.
      d. Partial occupancy before Final Acceptance.
      e. Use of premises restrictions.
      f. Provisions for future construction.
      g. Seasonal variations.
      h. Environmental control.
   4. Work Stages: Indicate important stages of construction for each major portion of the Work.

D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Punch List Inspection, and Final Inspection.

E. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using fragments to demonstrate the effect of the proposed change on the overall project schedule.

2.03 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

A. General: Prepare network diagrams using AON (activity-on-node) format. Submit two (2) opaque copies of initial schedule, large enough to show entire schedule for entire construction period.

B. CPM Schedule: Submit Contractor's Construction Schedule, simultaneously with the Schedule of Values (01 29 00) and the Draw Schedule (00 62 83), using a computerized, time-scaled CPM network analysis diagram for the Work in accordance with General Conditions, Article 9.
   1. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates, regardless of Owner's approval of the schedule.
   2. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
   3. Use "one workday" as the unit of time. Include list of nonworking days and holidays incorporated into the schedule.

C. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the preliminary network diagram, prepare a skeleton network to identify probable critical paths.
   1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:
      a. Preparation and processing of submittals.
      b. Mobilization and demobilization.
      c. Purchase of materials.
      d. Delivery.
      e. Fabrication.
      f. Utility interruptions.
      g. Installation.
      h. Work by Owner that may affect or be affected by Contractor's activities.
      i. Testing and commissioning.
   2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
   3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
   4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.
      a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.

D. Initial Issue of Schedule: Prepare initial network diagram from a list of straight "early start-total float" sort. Identify critical activities. Prepare tabulated reports showing the following:
   1. Contractor or subcontractor and the Work or activity.
   2. Description of activity.
   3. Principal events of activity.
   4. Immediate preceding and succeeding activities.
   5. Early and late start dates.
   6. Early and late finish dates.
   7. Activity duration in workdays.
   8. Total float or slack time.
   9. Average size of workforce.

E. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:
   1. Identification of activities that have changed.
   2. Changes in early and late start dates.
   3. Changes in early and late finish dates.
   4. Changes in activity durations in workdays.
   5. Changes in the critical path.
   6. Changes in total float or slack time.
   7. Changes in the Contract Time.

2.04 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
   1. List of subcontractors at Project site.
   2. Equipment at Project site.
   3. Material deliveries.
   4. High and low temperatures and general weather conditions.
   5. Accidents.
   6. Stoppages, delays, shortages, and losses.
   7. Meter readings and similar recordings.
   8. Orders and requests of authorities having jurisdiction.
   9. Services connected and disconnected.
   10. Equipment or system tests and startups.

B. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare and submit a detailed report. Submit with a request for interpretation. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

PART 3 - EXECUTION

3.01 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.
   1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
   2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
   3. As the Work progresses, indicate Actual Completion percentage for each activity.

B. Distribution: Distribute copies of approved schedule to Architect, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
   1. Post copies in Project meeting rooms and temporary field offices.
   2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION

SECTION 01 33 00 - SUBMITTAL PROCEDURES

PART 1 - GENERAL:

1.01 SUMMARY

A. Shop Drawings and samples shall be properly identified by project name, description or names of equipment, materials, and items, and complete identification of locations at which materials or equipment are to be installed.

1.02 SHOP DRAWINGS

A. Submit Shop Drawings for all items called for in the detail Specifications. Submit a minimum of six (6) black line prints of each Drawing, unless otherwise specified in the detail Specifications. Two prints of each Drawing will be retained by the Architect, the remaining prints will be returned to the Contractor. One print of each Drawing, bearing the final approval stamp of Architect, shall be kept at the project office and shall be maintained in good condition. No Shop Drawings other than those stamped "Approved" shall be on the job for any purpose and any work installed incorrectly from any Shop Drawing shall be removed and corrected at no change in contract price.

B. Approval will be for general design only and will not relieve Contractor from responsibility for errors or omissions in Shop Drawings, even though same were not indicated when approved.

C. In checking Shop Drawings, The Architect shall not be required to check dimensions, quantities, electrical characteristics, specific capacities, or coordination with other trades, these being the responsibility of the Contractor. Contractor shall attest, either in writing, by stamp, or signature, that all Shop Drawings submitted for approval have been checked for compliance with the Drawings and Specifications prior to submissions to the Architect otherwise they will be returned unchecked.

D. No Shop Drawings shall be submitted directly to the Architect from a manufacturer, jobber, or sub-contractor. All submittals shall be through the General Contractor.

E. Approvals shall not be construed as approved departure from Contract Drawings and Specifications.

1.03 SAMPLES

A. Furnish all samples called for in the detail Specifications and such other samples as the Architect may direct.

B. Samples or color selections shall include a complete selection of available colors and finishes. After Owner has selected colors and finishes, submit four additional samples of the selected colors and finishes which will become a master color guide to be used throughout the progress of the work.

1.04 SUBMISSION

A. Submission of Shop Drawings and samples shall be by a transmittal letter, in duplicate, containing project name, Contractor's name, Sub-contractor's and/or Vendor's name, a complete listing of Drawings or Samples submitted, and other pertinent data.

B. Samples of materials in connection with mechanical and electrical work may not be submitted to the Engineer. All samples of materials are to be submitted to the Architect.

C. Samples for the selection of colors and finishes shall be made in one submittal. No color selections will be made until samples on all items requiring color selection have been submitted.

END OF SECTION

SECTION 01 40 00 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Quality Control Requirements.
   2. Administrative and procedural requirements for quality assurance and quality control.

B. Related Sections:
   1. Section 01 32 00 - Construction Progress Documentation: Developing a schedule of required tests and inspections.
   2. Section 01 73 29 - Cutting and Patching: Repair and restoration of construction disturbed by testing and inspecting activities.
   3. Divisions 02 through 50 Sections: Specific test and inspection requirements.

1.02 QUALITY CONTROL REQUIREMENTS

A. General: The Contractor shall establish a system of inspections and tests of his work and that of his subcontractors to insure that all applicable requirements of the specifications are met.
   1. The Contractor shall be diligent to insure that the quality of workmanship is satisfactory, that dimensional requirements are met, that defective materials are not used and that all required control and laboratory testing procedures are effected.
   2. Where specific testing procedures are not stipulated, the Contractor shall establish and conduct a test procedure to insure adherence to specified quality.
   3. The Contractor shall make an initial inspection of each phase of work as soon as a representative portion has been completed, and the Contractor shall make daily follow-up inspections, to insure that an acceptable quality of work is established and maintained.
   4. The Contractor shall perform a pre-final inspection and work off all punch list items prior to Architect’s or Owner’s inspection(s).

1.03 DEFINITIONS

A. Conventional Inspections: Inspections, not specifically required by Code, which are considered essential to the proper performance of the building systems.

B. Inspections: Evaluation of systems, primarily requiring observation and engineering judgment.

C. Quality-Control Services: Conventional inspections, special inspections, tests, and related actions, including reports performed by Contractor, by independent agencies, and by governing authorities. Services do not include contract enforcement activities performed by Architect.

D. Special Inspections: Inspections, required by Code, which monitor the quality of materials and workmanship critical to the structural integrity of the building.

E. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

F. Mockups: Full-size, physical assemblies that are constructed on-site. Mockups are used to verify selections made under sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples. Approved mockups establish the standard by which the Work will be judged.

G. Laboratory Mockups: Full-size, physical assemblies that are constructed at testing facility to verify performance characteristics.

H. Preconstruction Testing: Tests and inspections that are performed specifically for the Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.

I. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction and the Owner, to establish product performance and compliance with industry standards.

J. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.

K. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

L. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

M. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
   1. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespeople of the corresponding generic name.

N. Experienced: When used with an entity, "experienced" means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.04 QUALITY ASSURANCE AND CONTROL SERVICES REQUIREMENTS

A. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
   1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
   2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.

B. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, the Contract Documents or authorities having jurisdiction are not limited by provisions of this Section.

1.05 CONFLICTING REQUIREMENTS

A. General: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement, unless directed otherwise by the Owner. Refer uncertainties and requirements that are different, but apparently equal, to the Architect, in writing, for the Owner’s decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect, in writing, for the Owner’s decision before proceeding.

1.06 SUBMITTALS

A. Qualification Data: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

B. Reports: Prepare and submit certified written reports that include the following:
   1. Date of issue.
   2. Project title and number.
   3. Name, address, and telephone number of testing agency.
   4. Dates and locations of samples and tests or inspections.
   5. Names of individuals making tests and inspections.
   6. Description of the Work and test and inspection method.
   7. Identification of product and Specification Section.

8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and re-inspecting.

C. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.07 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this Article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

C. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar to those indicated for this Project in material, design, and extent.

F. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 548; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.
1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

G. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

H. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
3. Demonstrate the proposed range of aesthetic effects and workmanship.
4. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
6. Demolish and remove mockups when directed, unless otherwise indicated.

1.08 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
   1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
   2. Payment for these services will be made from allowances, as authorized by the Owner.
   3. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Modification.

B. Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction, at no additional expense to the Owner or Architect. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
   1. Where services are not indicated as Owner's responsibility, engage a qualified testing agency to perform these quality-control services.
   2. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
   3. Notify testing agencies and Architect at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
   4. For all quality-control services that are not indicated as Owner's responsibility, submit a certified written report, in duplicate, of each quality-control service.
   5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
   6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 01 33 00 - Submittal Procedures.

D. Retesting/Re-inspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and re-inspecting, for construction that replaced Work that failed to comply with the Contract Documents.

E. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
   1. Notify Architect, Owner, and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
   2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
   3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
   4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
   5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
   6. Do not perform any duties of Contractor.

F. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
   1. Access to the Work.
   2. Incidental labor and facilities necessary to facilitate tests and inspections.
   3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
   4. Facilities for storage and field curing of test samples.
   5. Delivery of samples to testing agencies.

6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspecting equipment at Project site.

G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
1. Schedule times for tests, inspections, obtaining samples, and similar activities.

1.09 STANDARD AND INDUSTRY SPECIFICATIONS

A. Any material or operation specified by reference to the published specification of a manufacturer, The American Society for Testing and Materials (ASTM), The American Standards Association (ASA), Federal Specifications, or other published standard shall comply with the requirements of the current specification or standard listed. Should there be a discrepancy between the referenced specification and the contract documents the latter shall govern unless written interpretation is obtained from the Owner. Should there be discrepancies among referenced specifications or standards, the more stringent requirements shall govern.

B. The Contractor shall, if requested, furnish an affidavit from the manufacturer(s) certifying that the materials or products being furnished meet the requirements specified. Such certification, however, shall not relieve the Contractor from the responsibility of complying with other requirements of the contract documents.

1.10 MANUFACTURER'S DIRECTIONS

A. All manufactured articles, materials, and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned as directed by the manufacturers unless herein specified to the contrary. Should there be a discrepancy between an installation as required by the drawings and/or specifications and the manufacturer's directions and/or recommendations, such discrepancy shall be brought to the attention of the Architect and shall be resolved before the work may proceed.

1.11 APPROVED MATERIAL REQUIREMENTS

A. In the event the architectural, plumbing, mechanical and/or electrical requirements of any "APPROVED" material is different from that specified and/or as indicated on the drawings, any additional cost involved shall be the responsibility of the Contractor. No extra cost to the Owner or Architect will be allowed because of the use of such materials.

1.12 USE OF FOREIGN MATERIALS

A. The Contractor shall agree to use in the execution of this contract only materials, supplies, and products manufactured, mined, processed or otherwise produced in accordance with the Buy American Act (41 USC 10a-10d).

1.13 EXAMINATION OF SURFACES AND/OR CONDITIONS

A. The Contractor shall examine all surfaces on which, or against which, their work is to be applied and shall notify the Architect in writing of any defects the Contractor may discover which, in the Contractor's opinion, would be detrimental to the proper installation or operation of the Contractor's products. Commencing of work by the Contractor denotes acceptance by Contractor of all surfaces and conditions affecting Contractor's work.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
1. Comply with the Contract Document requirements for Section 01 73 29 - Cutting and Patching.

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION

SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.01 TEMPORARY OFFICES AND SHEDS

A. At the Contractor's Option, he may provide an office, storage sheds, and other structures as may be necessary to carry on the work.

B. Storage sheds shall be of sufficient size to hold materials required on the job site at one time, and shall have floors raised at least 1' 0" above the ground on heavy joists or sleepers. Sheds shall be watertight.

1.02 TELEPHONE (CONTRACTORS OPTION)

A. The Contractor may install, at his own expense, a single party job telephone, which shall be available for the use of all persons concerned with the construction of the project. All official long distance calls shall be paid by the General Contractor.

1.03 TOILET FACILITIES

A. The Contractor shall, at the beginning of the work, provide on the premises toilet facilities and enclosures for the use of all workmen on the project; shall maintain same in a sanitary condition; and shall remove same at the completion of the building and/ or when directed by the Architect or Owner.

B. The toilets shall, in construction details, equipment connections, and maintenance conform to all rules, regulations, and requirements of the City or County Health Department having jurisdiction.

1.04 RODENT AND VERMIN CONTROL

A. The Contractor shall provide on the job site ample and suitable containers with covers, and shall be fully responsible for containing and removing from the site all refuse from meals eaten on the site and other rodent or vermin attracting refuse. If the Contractor has the entire site the Contractor is solely responsible for ensuring that the site is rodent and vermin free at the Final Inspection.

1.05 SIGNS

A. No signs will be allowed on the premises except as required by the project specifications and/or as approved by the Owner.

1.06 PROTECTION

A. Provide and maintain all fences, planking, bridges, bracing, shoring, sheet piling, lights, barricades, warning signs, and guards as necessary for the protection of streets, sidewalks, landscaping, adjoining property, and the streets adjacent.

B. Provide protection for all shrubs, trees, lawns, walks, roads, drives, adjacent buildings and equipment, both on and off property, and in roads and streets adjacent.

1.07 REMOVAL

A. Temporary facilities shall be removed promptly as each becomes no longer required, but in all cases no later than the date of Final Acceptance.

1.08 STORAGE AND PARKING AREA

A. The amount of area and location that may be used for parking, storage of materials, equipment, sheds, and offices shall be as indicated by the Drawings or as directed by the Owner.

1.09 FIRST AID PROTECTION

A. General Contractor shall provide the following:
   1. First Aid Accident Cabinets.
   2. Emergency telephone numbers posted at telephone.

1.10 FIRE PRECAUTION DURING CONSTRUCTION

A. Emergency fire protection shall be provided for temporary sheds, new work, stacked materials, etc., using extinguishers, water pails and small hose streams, said equipment conforming to the requirements of the National Board of Fire Underwriters and relevant Insurance Co. Particular care shall be exercised when using open flame and welding and cutting equipment; use only flameproof type tarpaulins. Keep site clean and orderly with proper protection of combustibles while in use and in storage.

END OF SECTION

SECTION 01 60 00 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.01 PRODUCTS AND MATERIALS

A. Products, Materials, and manufactured items or articles of like nature, shall as nearly as possible, be of one brand or manufacturer. No changes or substitutions shall be made without written consent of the Owner.

1.02 TRADE NAMES

A. The use of manufacturer's names and model numbers are given to establish a standard of manufacture and not intended to be restrictive or preferential. Similar, equal, and approved materials of other manufacturers will be acceptable, subject to the approval of the Owner, pursuant to requirements set forth in Instruction to Bidders and as required by the Specifications.

1.03 MEASUREMENTS

A. Before ordering any material or doing any work, the Contractor shall verify all measurements of the building and shall be responsible for correctness of same. No extra charge or compensation will be allowed because of differences between actual measurements and the dimensions indicated on the Drawings. Any Differences which may be found, shall be submitted to the Architect for consideration before proceeding with the work.

1.04 SALVAGEABLE MATERIAL

A. Any salvageable material and or equipment shall remain the property of the Owner and upon removal from its existing location shall be stored where directed by the Owner. In the event that the Owner does not wish to keep the salvaged material, it shall be the responsibility of the Contractor to remove same promptly form the site.

PART 2 - PRODUCTS

2.01 PRODUCT OPTIONS

A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged, and unless otherwise indicated, that are new at time of installation.

B. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.

C. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.

D. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.

E. Where products are accompanied by the term “as selected,” Architect will make selection.

F. Where products are accompanied by the term “match sample,” sample to be matched is Architect’s.

G. Descriptive, performance, and reference standard requirements in the Specifications establish “salient characteristics” of products.

H. Or Equal: Where products are specified by name and accompanied by the term “or equal” or “or approved equal” or “or approved,” comply with provisions in “Comparable Products” Article to obtain approval for use of an unnamed product.

I. Product and Manufacturer Source: Where specification paragraphs or subparagraphs titled “Product” name a single product and manufacturer, provide the product names, unless otherwise indicated.

2.02 PRODUCT SUBSTITUTIONS

A. Proposed Substitutions During Bidding: In the technical sections of the specifications under Products heading, where only one manufacturer’s specific data - including material, model, specification, finish, color, or other specific identification - is noted, it is to indicate standards required and that manufacturer’s data is automatically approved. If another manufacturers

propose to bid on the work, including any other manufacturer listed in the specification section as a manufacturer, the Bidder shall submit full data to the Architect no later than 10 days prior to bid date and shall gain specific approval, via Addendum, on specific products prior to bidding. In the event submitted data of any manufacturer gains approval through this method, the manufacturer and the specific products will be published in an addendum prior to bid date. Only manufacturer's products listed in the original specifications or listed as approved in a subsequent addendum shall be used on the project. No other manufacturers or their products will be considered without prior written consent from the Owner.

B. Proposed Substitutions After Commencement Of The Work: Requests received during construction may be considered only when all of the following specific conditions are satisfied. IF the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

1. Submission, and approval of, Substitution Request Form During Construction – 01 25 14.
2. None of the approved products of the specified type are available.
3. Requested substitution has been coordinated with other portions of the Work.
4. Requested substitution provides specified warranty.
5. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

END OF SECTION

SECTION 01 73 00 - EXECUTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:
   1. Construction layout.
   2. General installation of products.
   3. Progress cleaning.
   4. Starting and adjusting.
   5. Protection of installed construction.
   6. Correction of the Work.

B. Related Sections include the following:
   1. 01 31 00 - "Project Management and Coordination" for procedures for coordinating field engineering with other construction activities.
   2. 01 33 00 - "Submittal Procedures" for submitting surveys.
   3. 01 77 00 - "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 EXAMINATION

A. Existing Conditions: The existence and location of site improvements, utilities, and other construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of mechanical and electrical systems and other construction affecting the Work.
   1. Before construction, verify the location and points of connection of utility services.

B. Existing Utilities: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning site work, investigate and verify the existence and location of underground utilities and other construction affecting the Work.
   1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; and underground electrical services.
   2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

C. Acceptance of Conditions: Examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
   1. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
      a. Description of the Work.
      b. List of detrimental conditions, including substrates.
      c. List of unacceptable installation tolerances.
      d. Recommended corrections.
   2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
   3. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
   4. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.

5. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.02 PREPARATION

A. Existing Utility Information: Furnish information to local utility that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents.

3.03 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
   1. Make vertical work plumb and make horizontal work level.
   2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
   3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
   4. Maintain minimum headroom clearance of 8 feet (2.4 m) in spaces without a suspended ceiling.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Final Acceptance.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

F. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

G. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.
   1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
   2. Allow for building movement, including thermal expansion and contraction.
   3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

H. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

I. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.04 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.
   1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
   2. Do not hold materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 deg F (27 deg C).
   3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
   1. Remove liquid spills promptly.
   2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Final Acceptance.

G. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Final Acceptance.

I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.05 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

B. Adjust operating components for proper operation without binding. Adjust equipment for proper operation.

C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Manufacturer's Field Service: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Division 01 Section "Quality Requirements."

3.06 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Final Acceptance.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

3.07 CORRECTION OF THE WORK

A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Division 01 Section "Cutting and Patching."

1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

B. Restore permanent facilities used during construction to their specified condition.

C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION

SECTION 01 73 29 - CUTTING AND PATCHING

PART 1 - GENERAL

1.01 CUTTING AND PATCHING PROPOSAL:

A. Submit a proposal describing procedures at least 10 days before the time cutting and patching will be performed, requesting approval to proceed. Include a description of cutting and patching and changes to existing construction, a list of products to be used and firms or entities that will perform the Work, dates when cutting and patching will be performed, and a list of utilities that cutting and patching procedures will disturb or affect.

B. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.
   1. Architect's Approval: Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

C. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.

D. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.

E. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
   1. If possible, retain original Installer or fabricator to cut and patch exposed Work listed below. If it is impossible to engage original Installer or fabricator, engage another recognized, experienced, and specialized firm.

F. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.01 GENERAL:

A. Comply with requirements specified in other Sections of these Specifications.

B. Existing Materials: Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
   1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of existing materials.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.

B. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
   1. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

C. Temporary Support: Provide temporary support of Work to be cut.

D. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

E. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

F. Existing Services: Where existing services are required to be removed, relocated, or abandoned, bypass such services before cutting to minimize interruption of services to occupied areas or the remainder of the building(s).

G. Performance: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
   1. Cut existing construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

H. Cutting: Cut existing construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
   1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
   2. Existing Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
   3. Concrete or Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
   4. Excavating and Backfilling: Comply with requirements in applicable Division 2 Sections where required by cutting and patching operations.
   5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
   6. Proceed with patching after construction operations requiring cutting are complete.

I. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications.
   1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
   2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
   3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
   4. Ceilings: Patch, repair, or re-hang existing ceilings as necessary to provide an even-plane surface of uniform appearance.
   5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.

END OF SECTION

SECTION 01 77 00 - PROJECT CLOSEOUT

(Revision Date: 9 April 2021)

PART 1 - GENERAL:

1.01 SUMMARY

A. The work under this Section consists of, but is not limited to; Submittals, Requirements and Procedures for Project close out.

1.02 RELATED SECTIONS

A. Section 01 33 00 - Submittal Procedures

B. Section 01 78 13 - Project Closeout Checklist

C. Section 00 65 20 – Final Completion Form

1.03 SUBMITTALS

A. Construction Completion Requests
   1. Certificate of Final completion
   2. Final Inspection

B. Close out Submittals: Three printed (hard) copies and three electronic copies in Adobe PDF format on CD or DVD-5 of close out submittals of which receipt and acceptance are prerequisites for final payment shall include, but not necessarily be limited to, the following:
   1. Affidavit of "Advertisement of Completion". Refer to Section 00 65 13.
   2. Evidence of Payments, and Release of Liens.
   3. General Contractors "One Year Guarantee".
   4. General Contractors “State of Alabama Roofing Guarantee”. Refer to Section 00 65 36 (If Applicable).
   5. Final Application for Payment.
   6. All required warranties and guarantees.

1.04 PUNCH LIST

A. Any salvageable material and or equipment shall remain the property of the Owner and upon removal from its existing location shall be stored where directed by the Architect. In the event that the Owner does not wish to keep the salvaged material, it shall be the responsibility of the Contractor to remove same promptly from the site.

B. Inspection:
   1. Prior to completion of the project, the Contractor shall fully prepare their own written Punch List. Upon completing correction of all Contractor generated Punch List items, the Contractor shall forward to the Owner and Architect a copy of their Punch List along with written notification that they have completed their entire list of items and are requesting a formal Punch List inspection.
   2. When the Owner confirms the Inspection date and time, the Architect will notify all parties in writing via e-mail the confirmed date and time for the Inspection. Cancellations of any scheduled Inspection must be received in writing no later than 48 hours prior to the scheduled Inspection. If the Inspection is canceled, it will be rescheduled subject to the Owner and Architect’s availability. Cancellations received less than 48 hours in advance shall incur a minimum $1,500.00 re-inspection fee.
   3. The Contractor is responsible for ensuring they and all their Sub-Contractors are completely ready for all Commissioning Activities and Inspections. If the Contractor and /or any of their associated Sub-contractors are not ready, then the Owner reserves the option to deduct from the Contractor all costs for the A/E team and Owner team participation due to failure of the Contractor and/or their Sub-contractors to be ready for Commissioning Activities or Inspections.

C. Rejection of Certification by Contractor:
   1. Should the Architect consider that work is not complete he will, on completion of inspection, immediately notify Contractor, in writing, stating reasons. Contractor shall complete work and send second written notice to the Architect certifying that project, or designated portion of project, is complete, after which the Architect and Owner representative will inspect work.

1.05 FINAL INSPECTION

A. Certification: Contractor shall submit written certification that: Contract Documents have been reviewed; project has been inspected for compliance with Contract Documents; Work has been completed in accordance with Contract Documents; Equipment and Systems have been tested in presence of Owner's Representative and are operational and Project is completed and ready for final inspection.

B. Inspection: Architect and Owner will make final inspection of the project within a reasonable time after receipt of certification. Should Owner consider that work is in fact complete in accord with requirements of Contract Documents, he will request Contractor to make Project Closeout Submittals. Should Owner consider that work is not complete, he will notify Contractor, in writing, stating reasons. Contractor shall take immediate steps to remedy stated deficiencies, and send second written notice to Architect certifying that work is complete. The Architect and Owner will re-inspect the work.

C. Certificate of Final Completion: Should the Owner consider that work is complete:
   1. Architect will prepare and issue a Certificate of Final Completion, or approved equal, complete with signatures of Owner and Contractor.
   2. For Owner occupancy of Project or designated portion of project, Contractor shall: perform final cleaning; and Contractor shall complete work listed for completion or correction, within designated time.

1.06 AS-BUILT DRAWINGS

A. Upon completion of this contract, the Contractor shall deliver to the Owner, at the Final Inspection, the three complete sets of legible drawings which vary from the original contract documents, showing all construction equipment, mechanical and electrical systems and connections as installed or built. All lettering and drawings shall be neat and recorded in permanent ink. The record drawings shall be supplemented by detailed sketches or drawings when necessary. "As-Built" Drawings not legible shall be completely redone.

B. The Owner shall approve Record Drawings, and shall be the sole judge of the acceptability of the Drawings.

C. Submit three electronic copies of all as built documents in Adobe PDF format on CD or DVD-5, simultaneous with the Closeout Documents.

1.07 OPERATION AND MAINTENANCE DATA

A. If applicable furnish three (3) complete sets of manuals containing manufacturer's instructions for operation and maintenance of each item of equipment and apparatus furnished under the Contract, detailed parts list and any additional data specifically required under various sections of the Specifications. Manuals shall be arranged in proper order, indexed and suitably bound in a 3-ring loose-leaf binder for 8 1/2" X 11" paper with black vinyl covers. Label binder with embossed plastic tape designating the name of Project, Owner, Contractor, and equipment of materials included in the manual. Certify by endorsement therein that each of the manuals is complete and accurate. Deliver manuals to the Owner at the Final Inspection of the project.

B. Submit three electronic copies of all manuals and documents in Adobe PDF format on CD or DVD-5, simultaneous with the Closeout Documents.

C. Special Requirements - Mechanical (if applicable): Operating instructions for the principal plant mechanical components, for use by operating personnel, shall be provided. They shall be laminated between thermoplastic sheets and affixed where directed by the Architect or Owner. Instructions shall describe the function of the equipment, its most economical operation, start-up and shut-down procedures, procedures to follow in event of failure, normal maintenance practices, and caution and warning notices.

D. Special Requirements - Electrical (if applicable): Frame under glass, or clear plastic, one print of the "As-Built" power riser diagram at main switch or switchboard location or at a location directed by the Architect or Owner. Provide circuit identification for each circuit in each panel board cabinet.

1.08 GUARANTEES AND BONDS

A. Contractor shall submit to the Architect, simultaneous with the Closeout Documents, all warranties, guarantees, and Surety Bonds. All such documents shall show the name and location of the Project and the name of the Owner.

1.09 INSTRUCTIONS

A. Instruct Owner's personnel in required roof maintenance and operation of all systems, mechanical, electrical and other equipment, prior to requesting the Punch List Inspection.

1.10 ADVERTISEMENT OF COMPLETION

A. Immediately after completion of the Contract, but not before receipt of a fully executed Final Completion Form, the General Contractor shall give notice of completion by an advertisement in the newspaper of general circulation published within the City or County wherein the work was done, once a week for four consecutive weeks.

B. In no case will a final settlement be made upon the Contract until the expiration of thirty (30) days from commencement of advertisement or before receipt of advertisement with affidavit as required by law.

C. Proof of publication of this Notice shall be submitted by the General Contractor, simultaneous with the Closeout Documents, by Affidavit of the publisher and a printed copy of the notice published. If no newspaper is published in the County, the notice must be posted at the Courthouse for thirty (30) days and proof shall be made by the Probate Judge or Sheriff and the Contractor.

1.11 EVIDENCE OF PAYMENTS AND RELEASE OF LIENS

A. Submit contractor's Affidavit of Payment of Debts and Claims: AIA G706, or approved equal.

B. Submit Contractor's Affidavit of Release of Liens: AIA G706A, or approved equal, with:
   1. Consent of Surety to Final Payment: AIA G707, or approved equal.
   2. Contractor's Release or Waiver of LIENS.

C. All submittals shall be duly executed before delivery to the Architect.

1.12 GENERAL CONTRACTORS GUARANTEE

A. The General Contractor shall submit in addition to any other expressed guarantees and/or warranties, a guarantee of all work under this Contract for a period of one year from date of final acceptance. Also, the General Contractor shall provide the State of Alabama Five-Year Roof Guarantee – if applicable.

1.13 FINAL ADJUSTMENT OF ACCOUNTS

A. Submit final statement of accounting to the Architect. Statement shall reflect all adjustments, including, but not necessarily limited to, the following:
   1. Original Contract Sum.
   2. Additions and deductions resulting from:
      a. Previous change orders.
      b. Cash allowances.
      c. Unit Prices.
      d. Other adjustments.
      e. Deductions for uncorrected work.
      f. Penalties and bonuses.
      g. Deductions for liquidated damages.
   3. Total Contract Sum, as adjusted.
   4. Previous payments.
   5. Sum remaining due.

1.14 FINAL APPLICATION FOR PAYMENT

A. Contractor shall submit final application in accord with requirements of General and/or Supplementary Conditions, simultaneous with the Closeout Documents.

1.15 YEAR END INSPECTION

A. Sixty days prior to expiration of one year from date of "Final Acceptance" Contractor shall notify the Architect, in writing, of year-end inspection. Year-end inspection shall occur no more than

forty-five and no less than fifteen days before the expiration of the Contractor's one year warranty. The Architect will make visual inspection of project in company with Owner and Contractor to determine whether correction of work is required, in accordance with provisions of General Conditions. For guarantees beyond one year, Architect will make inspections at request of Owner, after notification to Contractor. The Architect will promptly notify Contractor, in writing, of any observed deficiencies.

END OF SECTION

SECTION 01 78 13 - PROJECT CLOSEOUT CHECKLIST

PART 1 - GENERAL:

1.01 SUMMARY

A. This Section consists of a shortform checklist for required closeout documents / submittals.

1.02 RELATED SECTIONS

A. Section 01 77 00 - Project Closeout

1.03 REQUIREMENTS

A. See Section 01 77 00 for the full requirements of each of the follwoing:
   1. Fully executed copy of the Certificate of Final Completion with copy of original punchlist
   2. Original Affidavit of “Advertisement of Completion” - a copy of the ad must be attached to the affidavit form. (Not required if original awarded contract is less than $50,000.00)
   3. General Contractor’s Affidavit of Release of Liens
   4. General Contractor’s Affidavit of Payment of Debts and Claims - AIA G706A or approved equal
   5. Consent of Surety to Final Payment AIA G707 or approved equal (Not required if original awarded contract is less than $50,000.00)
   6. General Contractors “One Year Guarantee”
   7. General Contractor’s “State of Alabama Roof Guarantee" - if applicable
   8. Other warranties as required by contract
   9. As-Built Drawings - Changes should be legible, in permanent ink, and supplemented by detailed sketches or drawings when necessary
   10. Operating and Maintenance Manuals / Submittal / Product Literature & Technical Data

1.04 SUBMITTALS

A. Closeouts shall be submitted to the Architect in the following packages:
   1. Package #1 - **Final Pay Application Package** contains at least two (2) original pay applications with items #1 - #5 attached with binder clip or stapled - not in three ring binder or paper clipped.
   2. Package #2 - **Warranty Package** contains items #6 - #8 attached with binder clip or stapled - not in three ring binder or paper clipped.
   3. Package #3 - **Copy Package** contains copies of items #1 - #8 attached with binder clip or stapled - not in three ring binder or paper clipped.
   4. Package #4 - **Compact Disc Package** contains scans of items #1 - #10 in PDF format on a single CD, three CDs total, with each item saved by number from 1.03.A (above).

END OF SECTION

SECTION 01 78 39 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. This section includes administrative and procedural requirements for Project Record Documents, including the following:
   1. Record Drawings (As-Builts)
   2. Record Product Data

B. Related Sections:
   1. Section 01 77 00 - Project Closeout

1.02 SUBMITTALS

1.03 RECORD DRAWINGS: COMPLY WITH THE FOLLOWING:

A. Record Drawings - number of copies:

1. Punch-list Inspection: Submit one marked-up (red-lined) Record Drawings to the Architect and Owner's Representative at the start of the Punch-list Inspection for review. Any noted deficiencies are to be corrected prior to the Final Inspection.

2. Final Inspection: Submit three marked-up (red-lined) Record Drawings and three electronic CD copies containing all drawings in PDF format to the Owner at the start of the Final Inspection. Failure to provide the Record Prints (hard copy and/or CD), in the required quantities at the start of the Final Inspection, may result in the Owner immediately terminating the Final Inspection.

B. Record Project Data - number of copies:

1. Punch-list Inspection: Submit one set of Record Product Data for each item to the Architect and Owner's Representative at the start of the Punch-list Inspection for review. Any noted deficiencies are to be corrected prior to the Final Inspection.

2. Final Inspection: Submit three sets of corrected, bound Record Product Data and three electronic CD copies containing all Record Product Data in PDF format to the Owner at the start of the Final Inspection. Failure to provide the Record Product Data (hard copy and/or CD), in the required quantities at the start of the Final Inspection, may result in the Owner immediately terminating the Final Inspection.

PART 2 - PRODUCTS

2.01 RECORD DRAWINGS

A. Record Prints: Maintain one set of black-line white prints of the Contract Drawings and Shop Drawings at Project Site.
   1. Preparation: Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.
      a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
      b. Accurately record information in an understandable drawing technique.
      c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
      d. Content: Types of items requiring marking include, but are not limited to, the following:
         1) Dimensional changes to Drawings
         2) Revisions to details shown on Drawings
         3) Depths of foundations below first floor
         4) Locations and depths of underground utilities
         5) Revisions to routing of piping and conduits
         6) Revisions to electrical circuitry
         7) Actual equipment locations
         8) Duct size and routing

9) Locations of concealed internal utilities
10) Changes made by Change Order or Construction Change Directive
11) Changes made following Contract Modifications
12) Details not on the original Contract Drawings
13) Field records for variable and concealed conditions
14) Record information on the Work that is shown only schematically
15) Changes made by Addenda
16) Changes/Clarifications made by Contract Directive
17) Changes made by approved Shop Drawings

e. Mark Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings and physically append the Shop Drawings to final Record Drawings.
f. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at the same location.
g. Mark important additional information that was either shown schematically or omitted from original Drawings.
h. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, Addendum number(s), and similar identification, where applicable.

B. Record Drawings: When authorized, prepare a full sets of drawings of the corrected Contract Drawings, and record copy of all Shop Drawings.
1. Incorporate changes and additional information previously marked on Record Prints. Erase, redraw and add details and notation where applicable.
2. Refer instances of uncertainty to Architect for resolution.
3. Architect will furnish Contractor one set of Contract Drawings in electronic format, or .pdf files, for use in recording information.
4. Print the Contract Drawings and Shop Drawings for use as Record Drawings.

C. Format: Identify and date Record Drawing; include the designation “PROJECT RECORD DRAWING (AS-BUILTS)” in prominent location on the cover sheet.
1. Record Drawings: Organize into bound sets. Place Drawings in durable tube-type drawing containers with end caps. Mark end cap of each container with identification. If container does not include a complete set, identify Drawings included.
2. Identification: As follows:
a. Project name
b. Date
c. Designation “PROJECT RECORD DRAWINGS (AS-BUILTS)”
d. Name of Architect
e. Name of Contractor

2.02 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer’s written instructions for installation.
3. Note related Change Orders, Record Specifications, and Record Drawings where applicable.

PART 3 - EXECUTION

3.01 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and modifications to Project Record Documents as they occur; do not wait until the end of the project.

B. Maintenance of Record Documents and Samples: Store Record Documents and Samples in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and

in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Owner's and Architect's reference during normal working hours.

END OF SECTION

Maintenance Materials (Attic Stock)/Replacement Stock List

Material Name	% Materials	Manufacturer	Mfr. Number	Description	Product Type (mech, elect, HVAC, plumbing, controls, etc.)	Est. Current Cost	Date of Entry
Interior Items							
Ceiling Tiles	5%						
Window coverings	5%						
Ceramic Wall Tiles - field tiles	3%						
Ceramic Wall Tiles - specialty tiles	10%						
Paint	5% - not less than 1 gallon						
Flooring							
Carpet Tiles	5%						
Resilient Base	10 LF per 500 LF						
Resilient Flooring -Tiles	1 Box per 50 Boxes						
Hard Tile	3%						
Grout	5%						
Electrical							
Lamps (each type)	5%						
Exterior Items							
Paint	5% - not less than 1 gallon						
Brick/Split Face CMU	3%						
Wall pack lamps	5% - not less than 1						

SECTION 01 79 00 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Administrative and procedural requirements for instructing Owner's personnel, including the following:
   1. Demonstration of operation of systems, subsystems, and equipment.
   2. Training in operation and maintenance of systems, subsystems, and equipment.
   3. Demonstration and training video recordings.

B. Related Requirements:
   1. Divisions 01 through 49 Sections: Specific requirements for demonstration and training for products in those Sections.

1.02 INFORMATIONAL SUBMITTALS

A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module. This schedule must be submitted to the Architect **AT LEAST 14 DAYS IN ADVANCE** of the proposed training dates – if multiple dates are proposed, then the schedule must be submitted at least 14 days in advance of the earliest date on the schedule. Submission of the schedule after with less than fourteen days before the first date shall be sufficient grounds, by itself, for the Owner to reject the schedule, or any portion of the schedule. If the schedule is rejected by the Owner, then it will be rescheduled at no additional expense to the Owner or Architect. **ALL OPERATOR TRAINING MUST TAKE PLACE, AND RECORDINGS (1.03 A.) MUST BE PROVIDED TO ARCHITECT, PRIOR TO THE PUNCH LIST INSPECTION.** Failure to conduct and provide recordings prior to the Punch List Inspection will be grounds for cancellation of the Punch List Inspection.
   1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.

B. Qualification Data: For facilitator, instructor, and videographer.

C. Attendance Record: For each training module, submit list of participants and length of instruction time.

D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.03 CLOSEOUT SUBMITTALS

A. Demonstration and Training Video Recordings: Submit two (2) copies within seven (7) days of end of each training module.
   1. Identification: On each copy, provide an applied label with the following information:
      a. Name of Project.
      b. Name and address of videographer.
      c. Name of Architect.
      d. Name of Contractor.
      e. Date of video recording.
   2. Transcript: Prepared in PDF electronic format. Include a cover sheet with same label information as the corresponding video recording and a table of contents with links to corresponding training components. Include name of Project and date of video recording on each page.
   3. At Final Inspection, submit complete training manual(s) for Owner's use prepared and bound in format matching operation and maintenance manuals and in PDF electronic file format on compact disc.

1.04 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project,

and whose work has resulted in training or education with a record of successful learning performance.

B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in “Section 01 40 00 - Quality Requirements,” experienced in operation and maintenance procedures and training.

C. Videographer Qualifications: A professional videographer who is experienced photographing demonstration and training events similar to those required.

D. Pre-instruction Conference: Conduct conference at Project site. Review methods and procedures related to demonstration and training including, but not limited to, the following:
   1. Inspect and discuss locations and other facilities required for instruction.
   2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
   3. Review required content of instruction.
   4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.05 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 2 - PRODUCTS

2.01 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
   1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
      a. System, subsystem, and equipment descriptions.
      b. Performance and design criteria if Contractor is delegated design responsibility.
      c. Operating standards.
      d. Regulatory requirements.
      e. Equipment function.
      f. Operating characteristics.
      g. Limiting conditions.
      h. Performance curves.
   2. Documentation: Review the following items in detail:
      a. Emergency manuals.
      b. Operations manuals.
      c. Maintenance manuals.
      d. Project record documents.
      e. Identification systems.
      f. Warranties and bonds.
      g. Maintenance service agreements and similar continuing commitments.
   3. Emergencies: Include the following, as applicable:
      a. Instructions on meaning of warnings, trouble indications, and error messages.
      b. Instructions on stopping.
      c. Shutdown instructions for each type of emergency.

d. Operating instructions for conditions outside of normal operating limits.
e. Sequences for electric or electronic systems.
f. Special operating instructions and procedures.

4. Operations: Include the following, as applicable:
   a. Startup procedures.
   b. Equipment or system break-in procedures.
   c. Routine and normal operating instructions.
   d. Regulation and control procedures.
   e. Control sequences.
   f. Safety procedures.
   g. Instructions on stopping.
   h. Normal shutdown instructions.
   i. Operating procedures for emergencies.
   j. Operating procedures for system, subsystem, or equipment failure.
   k. Seasonal and weekend operating instructions.
   l. Required sequences for electric or electronic systems.
   m. Special operating instructions and procedures.
5. Adjustments: Include the following:
   a. Alignments.
   b. Checking adjustments.
   c. Noise and vibration adjustments.
   d. Economy and efficiency adjustments.
6. Troubleshooting: Include the following:
   a. Diagnostic instructions.
   b. Test and inspection procedures.
7. Maintenance: Include the following:
   a. Inspection procedures.
   b. Types of cleaning agents to be used and methods of cleaning.
   c. List of cleaning agents and methods of cleaning detrimental to product.
   d. Procedures for routine cleaning
   e. Procedures for preventive maintenance.
   f. Procedures for routine maintenance.
   g. Instruction on use of special tools.
8. Repairs: Include the following:
   a. Diagnosis instructions.
   b. Repair instructions.
   c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
   d. Instructions for identifying parts and components.
   e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.01 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual.

B. Set up instructional equipment at instruction location.

3.02 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
   1. Owner will furnish Contractor with names and positions of participants.

C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

1. Schedule training with Architect with at least fourteen (14) days' advance notice.

D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a performance-based test.

F. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

3.03 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

A. General: Engage a qualified commercial videographer to record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.
1. At beginning of each training module, record each chart containing learning objective and lesson outline.

B. Video: Provide minimum 640 x 480 video resolution converted to format file type acceptable to Owner, on electronic media.
1. Electronic Media: Read-only format compact disc acceptable to Owner, with commercial-grade graphic label.
2. File Hierarchy: Organize folder structure and file locations according to project manual table of contents. Provide complete screen-based menu.
3. File Names: Utilize file names based upon name of equipment generally described in video segment, as identified in Project specifications.
4. Contractor and Installer Contact File: Using appropriate software, create a file for inclusion on the Equipment Demonstration and Training DVD that describes the following for each Contractor involved on the Project, arranged according to Project table of contents:
   a. Name of Contractor/Installer.
   b. Business address.
   c. Business phone number.
   d. Point of contact.
   e. E-mail address.

C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to adequately cover area of demonstration and training. Display continuous running time.
1. Film training session(s) in segments not to exceed 15 minutes.
   a. Produce segments to present a single significant piece of equipment per segment.
   b. Organize segments with multiple pieces of equipment to follow order of Project Manual table of contents.
   c. Where a training session on a particular piece of equipment exceeds 15 minutes, stop filming and pause training session. Begin training session again upon commencement of new filming segment.

D. Light Levels: Verify light levels are adequate to properly light equipment. Verify equipment markings are clearly visible prior to recording.
1. Furnish additional portable lighting as required.

E. Narration: Describe scenes on video recording by audio narration by microphone while video recording is recorded. Include description of items being viewed.

F. Transcript: Provide a transcript of the narration. Display images and running time captured from videotape opposite the corresponding narration segment.

G. Pre-produced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

END OF SECTION

SECTION 02 41 00
DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Abandonment and removal of existing utilities and utility structures.
B. Selective demolition of curbs, sidewalks, paving, aggregate surfacing, etc.
C. Removal of above grade improvements and below grade improvements in conflict with proposed improvements.

1.02 RELATED REQUIREMENTS

A. Section 01 5713 - Temporary Erosion and Sediment Control.
B. Section 01 7000 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.
C. Section 01 7419 - Construction Waste Management and Disposal: Limitations on disposal of removed materials; requirements for recycling.
D. Section 31 1000 - Site Clearing: Vegetation, existing debris and topsoil removal.
E. Section 31 2200 - Grading: Topsoil removal.
F. Section 31 2200 - Grading: Fill material for filling holes, pits, and excavations generated as a result of removal operations. Topsoil removal.
G. Section 31 2323 - Fill: Fill material for filling holes, pits, and excavations generated as a result of removal operations.

1.03 REFERENCE STANDARDS

A. 29 CFR 1926 - U.S. Occupational Safety and Health Standards; current edition.
B. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2013.

1.04 SUBMITTALS

A. Site Plan: Showing:
   1. Areas for temporary construction and field offices.
B. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

PART 2 PRODUCTS

2.01 MATERIALS

A. Fill Material: As specified in Section 31 2323 - Fill.

PART 3 EXECUTION

3.01 SCOPE

A. Remove curbs, sidewalks, paving, retaining walls, aggregate surfacing, landings, etc. as required to accomplish new work.

B. Remove all other paving and curbs within construction limits indicated on drawings.

C. Within area of new construction, remove foundation walls and footings to a minimum of 2 feet below finished grade and as needed to allow for new work.

D. Remove concrete slabs on grade within construction limits indicated on drawings.

E. Remove manholes and manhole covers, curb inlets and catch basins.

F. Remove fences and gates.

G. Remove above grade improvements and below grade improvements in conflict with proposed improvements.

H. Remove septic tanks and field lines associated with building structures that been removed from the site. Septic tanks shall be pump out prior to removal. Septage shall be disposed of in a legal manner.

I. Fill excavations, open pits, and holes in ground areas generated as result of removals, using specified fill; compact fill as specified in Section 31 2323 Filling.

3.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
   1. Obtain required permits.
   2. Comply with applicable requirements of NFPA 241.
   3. Use of explosives is not permitted.
   4. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
   5. Provide, erect, and maintain temporary barriers and security devices.
   6. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
   7. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
   8. Do not close or obstruct roadways or sidewalks without permit.
   9. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.

B. Do not begin removal until receipt of notification to proceed from Owner.

C. Protect existing structures and other elements that are not to be removed.
   1. Provide bracing and shoring.
   2. Prevent movement or settlement of adjacent structures.
   3. Stop work immediately if adjacent structures appear to be in danger.

D. Minimize production of dust due to demolition operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.

E. If hazardous materials are discovered during removal operations, stop work and notify Engineer and Owner; hazardous materials include regulated asbestos containing materials, lead, PCB's, and mercury.

F. Partial Removal of Paving and Curbs: Neatly saw cut at right angle to surface.

G. Provide traffic control and when working near or adjacent to open roads, streets, walks, etc.

H. Provide temporary construction barricades to as needed to separate the work zone from open facilities and the public.

I. Protect site benchmark and property corners. If destroyed, replace site benchmark and property corners at no expense to the owner.

J. Protect existing improvements to remain and adjacent properties from damage.

K. Restore damaged improvements and adjoining properties as acceptable to party having jurisdiction and at no cost to the owner.

L. Provide positive drainage as needed to keep the site in a dry condition.

3.03 EXISTING UTILITIES

A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.

B. Protect existing utilities to remain from damage.

C. Do not disrupt public utilities without permit from authority having jurisdiction.

D. Provide temporary services during interruptions as needed.

E. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.

F. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.

G. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.

H. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

I. Prepare building demolition areas by disconnecting and capping utilities outside the demolition zone; identify and mark utilities to be subsequently reconnected, in same manner as other utilities to remain.

3.04 DEBRIS AND WASTE REMOVAL

A. Remove debris, junk, and trash from site.

B. Remove from site all demolished improvements.

C. Leave site in clean condition, ready for subsequent work.

D. All debris, waste and other demolished material shall be disposed of in a legal manner.

E. No burning of demolished material shall be allowed on site.

F. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION 02 41 00

DIVISION 02 00 00: EXISTING CONDITIONS
Section 02 41 13: Selective Demolition

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work-specified in this section.

1.02 SUMMARY

A. Extent of building demolition work includes the modifications, additions and removals to and from existing buildings as indicated on the drawings and/or described herein.

1.03 JOB CONDITIONS

A. Partial Removal: Items of salvable value to Contractor may be removed from structure as work progresses. Salvaged items must be transported from site as they are removed.

B. Traffic: Conduct demolition operations and removal of debris to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities.

C. Repair all damage to existing work, material and finish with materials of like type, quality and finish by skilled mechanics of the trades involved at no additional cost to the owner.

D. Protect existing work not to be removed from damage due to weather and exposure.

E. Utility Services: Maintain existing utilities indicated to remain, keep in service, and protect against damage during demolition operations.

F. Removing materials from roof surface: All materials being removed from roof surfaces greater than 20 feet above finished grade, shall be through enclosed chutes.

1.04 PROTECTION OF PERSONS AND PROPERTY

A. Provide protection of persons and property throughout the progress of the work and proceed in such a manner as to minimize the spread of dust and flying particles and to provide safe conditions for the occupants of the existing installation. Provide all necessary barriers, lights, warning signs and guards for the protection of the occupants of the existing installation. Cover and protect all interior furnishings, equipment and surface from falling dust resulting from re-roofing or above ceiling work. Contractor to remove and clean all such dust from interiors.

PART 2 - EXECUTION

2.01 DEMOLITION

A. Pollution Controls: Use water sprinkling, temporary enclosures, and other suitable methods to limit dust and dirt rising and scattering in air to lowest practical level. Comply with governing regulations pertaining to environmental protection.

B. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, pollution or property or building damage.

C. Clean adjacent structures and improvements of dust, dirt, and debris caused by demolition operations, as directed by Architect or governing authorities. Return adjacent areas to condition existing prior to start of work.

2.02 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Remove from site debris, rubbish, and other materials resulting from demolition operations.

B. Burning of removed materials from demolished structures will not be permitted on site.

C. Removal: Transport materials removed from demolished structures and dispose of off- site.

D. In the event that any hazardous materials are encountered during the course of demolition, all such materials must be disposed of in a legally approved manner. Notification of disposal of any items containing hazardous materials must be filed with the local landfill operator on the forms required by all governing authorities. The fully executed copy of these forms must be submitted to the Architect and the Owner. These forms must be filed prior to final payment.

END OF SECTION

DIVISION 03 00 00: CONCRETE
Section 03 11 00: Concrete Formwork

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Section includes the design and erection of formwork, shoring and reshoring for cast-in-place concrete and accessories.

1.2 RELATED SECTIONS

A. Section 01 31 00 – Submittal Procedures.

B. Section 03 20 00 - Concrete Reinforcement.

C. Section 03 30 00 - Cast-in-Place Concrete.

1.3 REFERENCES

A. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials.

B. ACI 301 - Standard Specifications for Structural Concrete.

C. ACI 318 - Building Code Requirements for Structural Concrete.

D. ACI 347 - Recommended Practice for Concrete Formwork.

E. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

F. ASTM E1643-09 - Standard Practice For Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact With Earth or Granular Fill Under Concrete Slabs.

G. ASTM E1745-09 - Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.

1.4 SUBMITTALS

A. Submit locations of construction joints for approval.

B. Submit manufacturer's data for waterstops.

1.5 DESIGN OF FORMWORK

A. Design of formwork and its removal is the sole responsibility of the Contractor.

B. Design of formwork shall conform to ACI 117, ACI 301, ACI 318, and ACI 347.

C. Design formwork in a manner such that existing or new construction is not overloaded.

PART 2 - PRODUCTS

2.1 FORM MATERIALS

A. Construct forms with wood, plywood, metal, fiberglass or a combination of these.

B. Form materials shall have sufficient strength to prevent distortion.

2.2 FORMWORK ACCESSORIES

A. Formwork accessories that are embedded in concrete, including ties and hangers, shall be commercially manufactured products. Do not use nonfabricated wire form ties.

2.3 FORM RELEASE AGENT

A. Form release agent shall not bond with, stain, nor adversely affect concrete surfaces.

2.4 WATERSTOPS

A. Waterstops at construction joints and control joints indicated by the Drawings shall be sized to suit the joints.

B. Waterstops shall be performed plastic adhesive waterstops as manufactured by SYNKO-FLEX Products or approved equal.

2.5 VAPOR RETARDER

A. Vapor retarder shall consist of a material having a permeance rating of 0.100 perm or less, when tested in accordance with ASTM E1745, and not less than ten mils thick.

2.6 EXPANSION JOINT FILLER

A. Asphalt impregnated premolded fiberboard expansion joint filler shall conform with ASTM D1751 and be 1/2-inch thick by full thickness of slab or joint, unless indicated otherwise on the Drawings.

2.7 CONSTRUCTION JOINTS

A. Provide key type steel forms by Vulcan screed joints, Burke Keyed Kold joint form or approved equal.

2.8 EMBEDDED PLATE ASSEMBLIES

A. Embedded steel plates, angles, and channels shall conform to ASTM A36, 36 ksi minimum yield strength, unless noted otherwise on the contract drawings.

B. Headed steel studs and their attachment to steel shall conform to the requirements of AWS D1.1.

C. Provide 3/4-inch diameter headed steel studs with 6-inch minimum embedment, unless noted otherwise.

D. Provide heat-resistant ceramic arc shields with studs.

PART 3 - EXECUTION

3.1 GENERAL

A. Erect formwork in accordance with ACI 301, ACI 318, and ACI 347.

B. Maintain formwork to support loads until such loads can be supported by concrete structure.

3.2 TOLERANCES

A. Finished work shall comply with ACI 117 tolerances.

3.3 SURFACE PREPARATION

A. For concrete exposed to view, seal form joints to prevent leakage.

B. Before reinforcement is placed, coat contact surfaces of form with form release agent in accordance with manufacturer's recommendations. Do not allow excess form release agent to accumulate in forms or come in contact with concrete surfaces against which fresh concrete will be placed.

3.4 CHAMFERS

A. Provide 3/4-inch chamfer at all formed corners.

3.5 FOUNDATION ELEMENTS

A. Form foundation elements if soil or other conditions are such that earth trench forms are unsuitable.

B. Sides of exterior grade beams, foundation walls, and turned-down slabs shall be formed.

C. Maintain minimum coverage of reinforcing steel as indicated on Structural Drawings.

3.6 INSERTS

A. Install and secure in position required inserts, sleeves, anchors, and nailers.

B. Locate anchor bolts by using templates with two nuts to secure in position.

3.7 EMBEDS

A. Set and secure embedded plates, bearing plates, and anchor bolts in accordance with approved setting drawings and in such a manner to prevent displacement during placement of concrete.

3.8 VAPOR RETARDER

A. Install Vapor Retarder to resist the transmission of water vapor through the exterior envelope.

B. Where indicated on Drawings, place vapor retarder over sewer and piping, but below conduits and ducts, and behind insulation and expansion joints at sidewalls.

C. Place, protect and repair vapor retarder in accordance with ASTM E1643. Lap vapor retarder six inches minimum at splices, sealing joints as required by the manufacturer with adhesive or pressure sensitive tape or both.

D. Do not puncture vapor retarder.

E. Vapor Retarder shall be installed above granular sub-base.

3.9 FORM REMOVAL

A. Remove forms carefully in such manner and at such time as to ensure complete safety of structure. Do not remove forms until members have acquired sufficient strength to support their weight and the load thereon safely.

3.10 PROVISIONS FOR OTHER TRADES

A. Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings and recesses from trades providing such items.

B. Accurately place and securely support items built into forms. Obtain approval for openings not shown on Drawings.

3.11 CLEANING

A. Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt or other debris just before concrete is placed.

3.12 FORM SURFACES

A. Coat contact surfaces of forms with a formcoating compound before reinforcement is placed. Apply in accordance with manufacturer's recommendations. Rust-stained steel formwork is not acceptable.

3.13 CONSTRUCTION JOINTS

A. Provide construction joints in accordance with ACI 318.

B. Obtain Architect/Structural Engineer's prior approval for use and location of joints.

C. Provide 1-1/2 inch deep key type construction joints at end of each placement for slabs, walls, and footings. Bevel forms for easy removal.

D. Remove loose particles and latency from surface prior to placing the next lift. Chip the surface to a depth sufficient to expose sound concrete.

END OF SECTION 03 11 00

DIVISION 03 00 00: CONCRETE
Section 03 20 00: Concrete Reinforcing

PART 1 - GENERAL

1.1 RELATED SECTIONS

A. Section 01 33 00 – Submittal Procedures.

B. Section 03 10 00 - Concrete Formwork.

C. Section 03 30 00 - Cast-in-Place Concrete (Building).

1.2 REFERENCES

A. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials.

B. ACI 301 - Standard Specifications for Structural Concrete.

C. ACI 315 - Details and Detailing of Concrete Reinforcement.

D. ACI 318 - Building Code Requirements for Structural Concrete.

E. ASTM A185 - Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.

F. ASTM A615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

G. ASTM A706 - Standard Specification for Low-Alloy Steel Deformed Bars for Concrete Reinforcement.

H. AWS D12.1 - Recommended Practices for Welding Reinforcing Steel Metal Inserts, and Connections in Reinforced Concrete Construction.

I. AWS D1.4 - Structural Weld Code - Reinforcing Steel.

J. CRSI - Manual of Practice, and Documents 63 and 65.

1.3 SUBMITTALS

A. Submit shop drawings as follows:

1. Notify Structural Engineer prior to detailing reinforcing steel shop drawings.
2. Indicate size, spacings, locations and quantities of reinforcing steel and wire fabric, bending and cutting schedules, splice lengths, stirrup spacing, supporting and spacing devices. Detail reinforcing steel in accordance with ACI 315 and CRSI Standards.
3. Written description of reinforcement without adequate sections, elevations, and details is not acceptable.
4. Reproduction of Structural Drawings for shop drawings is not permitted.

B. Submit, for information only, a certification from each manufacturer or supplier stating that materials meet the requirements of the ASTM and ACI standards referenced.

C. Submit, for information only, mill test reports.

D. Submit manufacturer's data for tensile and compressive splicers.

1.4 QUALITY ASSURANCE

A. Coordinate and schedule in a timely manner with the Structural Testing/Inspection Agency the following quality related items:

1. Verify reinforcing steel for quantity, size, location, and support.
2. Verify proper reinforcing steel concrete coverage.

1.5 STORAGE AND PROTECTING

A. Store reinforcing steel above ground so that it remains clean. Maintain steel surfaces free from materials and coatings which might impair bond.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Deformed reinforcing steel shall conform to ASTM A615, refer to Structural Drawings for grade (Grade 60 minimum).

B. Welded steel wire fabric shall conform to ASTM A185.

2.2 ACCESSORY MATERIALS

A. Annealed steel tie wire shall be 16-1/2 gage minimum.

B. Bar supports shall be plastic-tipped steel Class I bar supports conforming to CRSI Specifications. Concrete brick may be used to support reinforcement to obtain proper clearance from earth.

2.3 SPLICERS

A. Tensile splicers shall be capable of developing 125% of the reinforcing steel ASTM specified minimum yield strength.

B. Compression splicers shall be the mechanical type such that the compression stress is transmitted by end bearing held in concentric contact.

2.4 DOWEL ADHESIVE

A. Adhesive for dowels in existing concrete shall be either EPCON System Ceramic 6 Epoxy adhesive supplied by ITW Ramset/Red Head, HIT HY150 injection adhesive supplied by Hilti Fastening Systems, Power-Fast epoxy injection gel supplied by Powers Fastening Company, Acrylic-Tie adhesive supplied by Simpson Strong-Tie Co., or approved equal.

PART 3 - EXECUTION

3.1 FABRICATION

A. Fabricate steel in accordance with ACI 318 and CRSI standards.

B. Bend bars cold. Do not heat or flame cut bars. No field bending of bars partially embedded in concrete is permitted, unless specifically approved by Structural Engineer and checked by Testing and Inspection Agency for cracks.

C. Weld only as indicated. Perform welding in accordance with AWS D12.1 and or AWS D1.4.

D. Tag reinforcing steel for easy identification.

3.2 INSTALLATION

A. Before placing concrete, clean reinforcement of foreign particles and coatings.

B. Place, support, and secure reinforcement against displacement in accordance with ACI 318 and CRSI standards. Do not deviate from alignment or measurement.

C. Place concrete beam reinforcement support parallel to main reinforcement.

D. Locate welded wire fabric in the top third of slabs. Overlap mesh one lap plus two inches at side and end joints.

E. Furnish and install dowels or mechanical splices at intersections of walls, columns and piers to permit continuous reinforcement or development lengths at such intersections.

F. Maintain cover and tolerances in accordance with ACI and CRSI Specifications, unless indicated otherwise on Structural Drawings.

3.3 SPLICES

A. Do not splice reinforcement except as indicated on Structural Drawings.

B. Tension couplers may be used and installed in accordance with manufacturer's specifications.

3.4 DOWELS IN EXISTING CONCRETE

A. Install dowels and dowel adhesive in accordance with manufacturer’s recommendations.

B. Minimum embedment length shall be 12 bar diameters, unless noted otherwise.

END OF SECTION 03 20 00

DIVISION 03: CONCRETE
Section 03 30 00: Cast-In-Place Concrete (Building)

PART 1 - GENERAL

1.01 QUALITY ASSURANCE

A. Codes and Standards: Comply with provisions of following codes, specifications and standards, except where more stringent requirements are shown or specified:

ACI 301 "Specifications for Structural Concrete for Buildings."

ACI 318 "Building Code Requirements for Reinforced Concrete."

ACI 347 "Recommended Practice for Concrete Formwork."

Concrete Reinforcing Steel Institute, "Manual of Standard Practice."

1.02 SUBMITTALS: Submit manufacturer's product data with installation instructions for proprietary materials including reinforcement and forming accessories, admixtures, joint materials, hardeners, curing materials and others as requested by Architect.

A. Submit design mixes of each individual type of concrete to be used on the project prior to the start of concrete work. Tests shall be made for compressive strength, slump and air entrainment. Proportion mixes in compliance with mix design procedures specified in ACI 301 and requirements stated on the plans.

B. Submit shop drawings for fabrication, bending, and placement of concrete reinforcement. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar schedules, stirrup spacing, diagrams of bent bars, arrangement of concrete reinforcement. Include special reinforcement required for openings through concrete structures.

C. Concrete Testing Service: The Contractor shall employ, at his sole expense, an independent testing agency acceptable to the Architect/Engineer to perform sampling and testing during concrete placement as follows. Refer to Section 01400 for additional requirements for Testing Agency.
1. Sampling: ASTM C 172.
2. Slump: ASTM C 143, one of test for each load at point of discharge.
3. Air Content: ASTM C 173, one for each set of compressive strength specimens.
4. Compressive Strength: ASTM C 39, Three sets for each 25 cu. yds. or fraction thereof of each class of concrete; one specimen tested at 7 days, two specimens tested at 28 days, and one retained for later testing if required. When the total quantity of a given class of concrete is less than 25 cu. yds., strength tests may be waived by Architect if field experience indicates evidence of satisfactory strength.
5. Test Results will be reported in writing to Architect, Contractor, and concrete producer within 24 hours after tests are made.

PART 2 - PRODUCTS

2.01 FORM MATERIALS

A. Forms for Exposed Finish Concrete: Unless otherwise indicated, construct formwork for exposed concrete surfaces with plywood, metal, metal-framed plywood faced or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings. Provide form material with sufficient thickness to withstand pressure of newly-placed concrete without bow or deflection.
   1. Use plywood complying with U.S. Product Standard PS-1 "B-B (Concrete Form) Plywood," Class I, Exterior Grade or better, mill-oiled and edge-sealed, with each piece bearing legible inspection trademark.

B. Forms for Unexposed Finish Concrete: Form concrete surfaces which will be unexposed in finished structure with plywood, lumber, metal or other acceptable material. Provide lumber dressed on at least 2 edges and one side for tight fit.

C. Cylindrical Columns and Supports: Form round-section members with metal, fiberglass reinforced plastic, or paper or fiber tubes. Construct paper or fiber tubes of laminated plies using water-resistant adhesive with wax-impregnated exterior for weather and moisture protection. Provide units with sufficient wall thickness to resist loads imposed by wet concrete without deformation.

D. Form Coatings: Provide commercial formulation form-coating compounds that will not bond with, stain nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces.

2.02 REINFORCING MATERIALS

A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.

B. Supports for Reinforcement: Provide supports for reinforcement including bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing bars and welded wire fabric in place. Use wire bar type supports complying with CRSI specifications, unless otherwise acceptable.

2.03 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150, Type I, unless otherwise acceptable to Architect.

   Use one brand of cement throughout project, unless otherwise acceptable to Architect.

B. Normal Weight Aggregates: ASTM C 33, and as herein specified. Provide aggregates from a single source for exposed concrete.
   1. Local aggregates not complying with ASTM C 33 but which have shown by special test or actual service to produce concrete of adequate strength and durability may be used when acceptable to Architect.
   2. The aggregate shall not exceed 1" in its maximum dimensions for foundation and slab work nor 3/8" (pea gravel) for concrete block lintels and filled cells.
   3. Lightweight Aggregates: ASTM C 330.
   4. Water: Drinkable.
   5. Air-Entraining Admixture: ASTM C 260.
      a. Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to the following:

"Sika Aer"; Sika Corp
"MB-VR or MB-AE"; Master Builders
"Dorex AEA"; W.R. Grace
"Edoco 2001 or 2002"; Edoco Technical Product

2.04 RELATED MATERIALS: Submit any product not specifically listed in this specification to Architect for approval.

A. Vapor Barrier: Provide vapor barrier cover over prepared base material where indicated. Use only materials which meet ASTM 1745-09, not less than 15 mils thick, and are resistant to decay when tested in accordance with ASTM E154. Product must maintain a permeance of less than 0.01 perms after mandatory conditioning tests include in ASTM E 1745-09, Section 7.12, 7.1.3, 7.1.4 and 7.1.5. Install material according to ASTM E 1643-09. Lap vapor barrier a minimum of 6” at all locations.

B. Non-Shrink Grout: CRD-C 621, factory pre-mixed grout.
1. Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:
a. Non-metallic

"Masterflow 713"; Master Builders
"Euco-NS"; Euclid Chemical Co.

C. Liquid Membrane Forming Curing Compound: Liquid type membrane-forming curing compound complying with ASTM C 309, Type I, Class A unless other type acceptable to Architect. Moisture loss not more than 0.055 gr./sp. cm. when applied at 200 sq. ft./gal.
1. Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:

"Masterseal"; Master Builders
"Ecocure"; Euclid Chemical Co.
"Clear Seal"; A. C. Horn
"Kure-N-Seal"; Sonneborn-Contech

D. Cure, Sealer and Dustproofer: ASTM C-309, containing 250% solids. ADay-Chem Cure & Seal@ (J-22) by Dayton Superior OR approved equal. Surface shall have a high gloss finish.

2.05 PROPORTIONING AND DESIGN OF MIXES

A. Prepare design mix for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. If trial batch method is used, use an independent testing facility acceptable to Architect for preparing an reporting proposed mix designs. The testing facility shall not be the same as used for field quality control testing unless otherwise acceptable to Architect.

B. Submit written reports to Architect of each proposed mix for each class of concrete at lease 15 days prior to start of work. Do not begin concrete production until mixes have been reviewed by Architect.

C. Design mixes to yield normal weight concrete with the following properties, as indicated on drawings and schedules:

Concrete in slabs and footings shall have a minimum compressive strength of 3000 strength psi and in beams and columns a minimum compressive strength of 4000 psi at 28-days; the maximum W/C ratio shall be 0.46 maximum (air-entrained).

RETEMPERING OR ADDING WATER AT THE JOBSITE IS PROHIBITED.

D. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant; at no additional cost to Owner and as accepted by Architect. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Architect before using in work.

E. Admixtures: Use air-entraining admixture in exterior exposed concrete, unless otherwise indicated. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having total air content with a tolerance of plus-or-minus 1-1/2% within following limits:

Concrete structures and slabs exposed to freezing and thawing, deicer chemicals, or subjected to hydraulic pressure:

4.5% (moderate exposure); 5.5% (severe exposure) 1-1/2" max. aggregate.
5.0% (moderate exposure); 6.0% (severe exposure) 3/4" max. aggregate.

Other Concrete: 2% to 4% air.

F. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:

Ramps, slabs, and sloping surfaces: 4” (+/-1”).

Reinforced foundation systems: 4” (+/-1”).

Pea gravel pump mix for filled masonry cells (3000 psi) C 8” to 11".

Other concrete: Not more than 4", except when slump is increased by use of super plasticizers.

2.06 CONCRETE MIXES

A. Ready-Mix Concrete: Comply with requirements of ASTM C 94, and as herein specified.

During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C 94 may be required.

When air temperature is between 85^{o}F (30^{o}C) and 90^{o}F (32^{o}C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 90^{o}F (32^{o}C), reduce mixing and delivery time to 60 minutes.

Exposed concrete slab concrete shall not be pumped unless it contains super plasticizers, and ARecover@ admixture as manufacturered by W.R.Grace Co.

B. The following are strictly prohibited:

a. Partially hardened concrete.
b. Contaminated concrete.
c. Re-tempered concrete.
d. Concrete that has been re-mixed after it has taken its initial set.

2.07 CONCRETE TOPPING

A. Provide Level-Right Self-Leveling Floor Underlayment by Maxxon Corporation in locations indicated on drawings. Comply with manufacturer=s requirements and the following:

1. Compressive Strengths: Modified ASTM C 109; up to 3000 psi (3 day).
2. Tensile Strength: ASTM C 190; 720 psi (28 day).
3. Surface Buring Characteristic: Flame Spread - 0.
   Fuel Contribution - 0.
   Smoke Development - 0. (ASTM E 84).
4. Fire Ratings: U.L. Design #J919, L514, L528, L530

PART 3 - EXECUTION

3.01 FORMS

A. Design, erect, support, brace and maintain formwork to support vertical and lateral loads that might be applied until such loads can be supported by concrete structure. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation and position.

B. Design formwork to be readily removable without impact, shock or damage to cast-in-place concrete surfaces and adjacent materials.

C. Construct forms to sizes, shapes, lines and dimensions shown, and to obtain accurate alignment, location, grades, level and plumb work in finished structures. Provide for openings, offsets, keyways, recesses, blocking, screeds, bulkheads, anchorages and inserts, and other features required in work. Use selected materials to obtain required finishes. Solidly butt joints and provide back-up at joints to prevent leakage of cement paste.

D. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and for easy removal.

E. Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Securely brace temporary openings and set time to forms to prevent loss of concrete mortar. Locate temporary openings on forms at inconspicuous locations.

F. Chamfer exposed corners and edges as indicated, using wood, metal, PVC or rubber chamfer strips fabricated to product uniform smooth lines and tight edge joints.

G. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses and chases from trades providing such items. Accurately place and securely support items built into forms.

H. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt or other debris just before concrete is placed. Retighten forms and bracing after concrete placement is required to eliminate

mortar leaks and maintain proper alignment.

3.02 PLACING REINFORCEMENT: Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars," for details and methods of reinforcement placement and supports, and as herein specified.

A. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials which reduce or destroy bond with concrete. Reinforcing must also be free of non-shop bends or kinks.

B. Accurately position, support and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required.

C. Place reinforcement to obtain at least minimum coverage's for concrete protection and lap as specified by ACI. Arrange, space and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

D. Install welded wire fabric in as long lengths as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset end laps in adjacent widths to prevent continuous laps in either direction.

E. Reinforcing bars shall be free of kinks and non-shop bends. Field bends shall only be installed as directed by the Architect.

3.03 JOINTS

A. Construction Joints: Locate and install keyed construction joints as indicated or, if not indicated, locate so as not to impair strength and appearance of the structure, as acceptable to Architect.

B. Provide keyways at least 1-1/2" deep in construction joints in walls, slabs and between walls and footings; accepted bulkheads designed for this purpose may be used for slabs.

C. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints.

D. Isolation Joints in Slabs-on-Ground: Construct isolation joints in slabs-on-ground at points of contact between slabs on ground and vertical surfaces, such as column pedestals, foundation walls, grade beams and elsewhere as indicated.

Joint filler and sealant materials are specified in Division-7 sections of these specifications.

E. Contraction (Control) Joints in Slabs-on-Ground: Construct contraction joints in slabs-on-ground to form panels of patterns as shown. If not shown, provide joints recommended by ACI Standards. Use inserts 1/8" to 1/4" wide x 1/4 of slab depth, unless otherwise indicated.

F. Form contraction joints by inserting premolded plastic, hardboard or fiberboard strip into fresh concrete until top surface of strip is flush with slab surface. Tool slab edges round on each side of insert. After concrete has cured, remove inserts and clean groove of loose debris.

Contraction joints may be formed by saw cuts as soon as possible after slab finishing and without dislodging aggregate. Depth of saw cut to be 1/4 of slab thickness.

G. Joint sealant material is specified in Division-7 sections of these specifications.

H. Clean construction joints prior to placement of concrete including removal of all laitance. Immediately before concrete is placed, wet all construction joints and remove all standing water.

3.04 INSTALLATION OF EMBEDDED ITEMS: Set and build into work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in- place concrete. Use setting drawings, diagrams, instructions and directions provided by suppliers of items to be attached thereto.

A. Edge Forms and Screed Strips for Slabs: Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in finished slab surface. Provide and secure units sufficiently strong to support types of screed strips by use of strike-off templates or accepted compacting type screeds.

3.05 PREPARATION OF FORM SURFACES

A. Clean re-used forms of concrete matrix residue, repair and patch as required to return forms to acceptable surface condition.

B. Coat contact surfaces of forms with a form-coating compound before reinforcement is placed.

C. Thin form-coating compounds only with thinning agent of type, and in amount, and under conditions of form-coating compound manufacturer's directions. Do not allow excess form-coating material to accumulate in forms or to come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions.

3.06 CONCRETE PLACEMENT

A. Preplacement Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast- in. Notify other crafts to permit installation of their work, cooperate with other trades in setting such work. Moisten wood forms immediately before placing concrete where form coatings are not used.

B. Coordinate the installation of joint materials and moisture barriers with placement of forms and reinforcing steel.

C. General: Comply with ACI 304 "Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete," and as herein specified.

D. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation.

E. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 24" and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic, to avoid cold joints. Concreting operations shall be carried on at such a rate that the concrete is at all times plastic.

F. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, Roding or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI recommended practices.

G. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Place vibrators to rapidly penetrate placed layer and at least 6" into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.

H. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed.

I. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.

J. Bring slab surfaces to correct level with straightedge and strikeoff. Use bull floats or darbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.

K. Maintain reinforcing in proper position during concrete placement operations.

L. Cold Weather Placing: Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 306.

M. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.

N. Do not use calcium chloride, salt and other materials containing antifreeze agents or chemical accelerators, unless otherwise accepted in mix designs.

O. Hot Weather Placing: When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACI 305.

P. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.

Q. Concrete is prohibited from being placed if the concrete is partially hardened, contaminated, re-tempered, or if it has been re-mixed after its initial set.

3.07 FINISH OF FORMED SURFACES

A. Rough Form Finish: For formed concrete surfaces not exposed-to-view in the finish work or by other construction, unless otherwise indicated. This is the concrete surface having texture imparted by form facing material used, with tie holes and defective areas repaired and patched and fins and other projections exceeding 1/4" in height rubbed down or chipped off.

B. Smooth Form Finish: For formed concrete surfaces exposed to view, or that are to be covered with a coating material applied directly, to concrete, or a covering material applied directly to concrete, such as waterproofing, damp-proofing, painting or other similar system. This is as-cast concrete surface obtained with selected form facing

material, arranged orderly and symmetrically with a minimum of seams. Repair and patch defective areas with fins or other projections completely removed and smoothed.

C. Grout Cleaned Finish: Provide grout cleaned finish to cylindrical column surfaces which have received smooth form finish treatment.

Combine one part portland cement to 1-1/2 parts fine sand by volume, and mix with water to consistency of thick paint. Proprietary additives may be used at Contractor's option. Blend standard portland cement and white portland cement, amounts determined by trial patches, so that final color of dry grout will match adjacent surfaces.

Thoroughly wet concrete surfaces and apply grout to coat surfaces and fill small holes. Remove excess grout by scraping and rubbing with clean burlap. Keep damp by fog spray for at least 36 hours after rubbing.

3.08 MONOLITHIC SLAB FINISHES

A. Trowel Finish: Apply trowel finish to monolithic slab surfaces to be exposed-to-view, and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint or other thin film finish coating system.

After floating, begin first trowel finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand- troweling operation, free of trowel marks, uniform in texture and appearance, and with a level surface plane so that depressions between high spots do not exceed 1/8" under a 10' straightedge. Grind smooth surface defects which would telegraph through applied floor covering system.

B. Non-Slip Broom Finish: Apply non-slip broom finish to exterior concrete sidewalks, steps and ramps, and elsewhere as indicated.

Immediately after trowel finishing, slightly roughen concrete surface by brooming with fiber bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.09 CONCRETE CURING AND PROTECTION: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Keep continuously moist for not less than 7 days at 50^{o}F. minimum temperature. Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least 7 days in accordance with ACI 301 procedures. Avoid rapid drying at end of final curing period.

A. Curing Methods: Perform curing of concrete by curing and sealing compound, by moist curing, by moisture-retaining cover curing, and by combinations thereof, as herein specified.

Where sealed concrete is the Afinish floor@, moist curing is required. Where interior slabs are to be covered with VCT, resilient flooring, or carpet, etc., curing method is Contractor=s Option.

B. Provide moisture curing by following methods.

Keep concrete surface continuously wet by covering with water.

Covering concrete surface with specified absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4" lap over adjacent absorptive covers.

C. Provide moisture-cover curing as follows:

Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3" and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

D. Provide curing and sealing compound to interior slabs with resilient flooring, carpet over cushion; and to exterior slabs, walks, and curbs, as follows:

Applied specified curing and sealing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours). Apply uniformly in continuous operation by power-spray or roller in accordance with manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.

E. After moist curing of exposed concrete floor areas, provide two (2) coats of sealing compound.

Do not use membrane curing compounds on surfaces which are to be covered with coating material applied directly to concrete, liquid floor hardener, waterproofing, damp-proofing, membrane roofing, flooring (such as ceramic or quarry tile, glue-down carpet), painting, and other coatings and finish materials, unless otherwise acceptable to Architect.

F. Curing Formed Surfaces: Cure formed concrete surfaces, including undersides of beams, supported slabs and other similar surfaces by moist curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

G. Curing Unformed Surfaces: Cure unformed surfaces, such as slabs, floor topping, and other flat surfaces by application of appropriate curing method.

Final cure concrete surfaces to receive liquid floor hardener or finish flooring by use of moisture-retaining cover, unless otherwise directed.

H. Sealer and Dustproofer: Apply a second coat of specified curing and sealing compound only to surfaces given a first coat.

3.10 REMOVAL OF FORMS AND SHORING

A. Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50^{o} F (10^{o} C) for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal operations, and provided curing and protection operations are maintained.

B. Formwork or shoring supporting weight of concrete, such as beam soffits, joints, slabs and other structural elements, may not be removed in less than 14 days and until concrete has attained design minimum compressive strength at 28-days. Determine potential compressive strength of in place concrete by testing field-cured specimens representative of concrete location or members.

C. Form facing material may be removed 4 days after placement, only if shores and other vertical supports have been arranged to permit removal of form facing material without loosening or disturbing shores and supports.

3.11 RE-USE OF FORMS: Clean and repair surfaces of forms to be re-used in work. Split, frayed, delaminated or otherwise damaged from facing material will not be acceptable for exposed surfaces. Apply new form coating compound as specified for new formwork.

3.12 MISCELLANEOUS CONCRETE ITEMS

A. Filling-In: Fill-in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place and cure concrete as herein specified, to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersections and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations, as shown on drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with certified diagrams or templates of manufacturer furnishing machines and equipment.

D. Grout base plates and foundations as indicated, using specified non-shrink grout. Use non- metallic grout for exposed conditions, unless otherwise indicated.

E. Reinforced Masonry: Provide concrete for reinforced masonry lintels and bond beams where indicated on drawings and as scheduled. Maintain accurate location of reinforcing steel during concrete placement.

3.13 CONCRETE SURFACE REPAIRS

A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removal of forms, when acceptable to Architect.

Cut out honeycomb, rock pockets, voids over 1/4" in any dimension, and holes left by tie rods and bolts, down to solid concrete but, in no case to a depth of less than 1". Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water and brush- coat the area to be patched with specified bonding agent. Place patching mortar after bonding compound has dried.

B. For exposed-to-view surfaces, blend white portland cement and standard portland cement so that, when dry, patching mortar will match color surrounding. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.

C. Repair of Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Architect. Surface defects, as such, include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets; fins and other projections on surface; and stains and other discolorations that cannot be removed by cleaning; flush out form tie holes, fill with dry pack mortar, or precast cement cone plugs secured in place with bonding agent.

D. Repair concealed formed surfaces, where possible, that contain defects that affect the durability of concrete. If defects cannot be repaired, remove and replace concrete.

E. Repair of Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface plane to tolerances specified for each surface and finish. Correct low and high areas as herein specified. Test unformed surfaces sloped to drain

for trueness of slope, in addition to smoothness using a template having required slope.

F. Repair finished unformed surfaces that contain defects which affect durability of concrete. Surface defects, as such, include crazing, cracks in excess of 0.01" wide or which penetrate to reinforcement of completely through non-reinforced sections regardless of width, spalling, pop-outs, honeycomb, rock pockets and other objectionable conditions.

G. Correct high areas in unformed surfaces by grinding, after concrete has cured at least 14 days.

H. Correct low areas in unformed surfaces during, or immediately after completion of surface finishing operations by cutting out low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Proprietary patching compounds may be used when acceptable to Architect.

I. Repair defective areas, except random cracks and single holes not exceeding 1" diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts and expose reinforcing steel with at least 3/4" clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding compound. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact and finish to blend with adjacent finish concrete. Cure in same manner as adjacent concrete.

J. Repair isolated random cracks and single holes not over 1" in diameter by dry-pack method. Groove top of cracks and cut-out holes to sound concrete and clean of dust, dirt and loose particles. Dampen cleaned concrete surfaces and apply bonding compound. Mix dry-pack, consisting of one part portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing. Place dry-pack after bonding compound has dried. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched area continuously moist for not less than 72 hours.

K. Perform structural repairs with prior approval of Architect or method and procedure, using specified epoxy adhesive and mortar.

L. Repair methods not specified above may be used, subject to acceptance of Architect.

3.14 QUALITY CONTROL TESTING DURING CONSTRUCTION

A. The Contractor will employ a testing laboratory to perform tests and to submit test reports.

B. Sampling and testing for quality control during placement of concrete includes the following, as directed by Architect.

C. Sampling Fresh Concrete: ASTM C172, except modified for slump to comply with ASTM C94.

1. Slump: ASTM C143; one test at point of discharge for each day's pour of each type of concrete; additional tests when concrete consistency seems to have changed.

2. Air Content: ASTM C 173; volumetric method for lightweight or normal weight concrete; ASTM C 231 pressure method for normal weight concrete; one for each day's pour of each type of air- entrained concrete.

3. Concrete Temperature: Test hourly when air temperature is 40^{o}F 4^{o}C) and

below, and when 80°F (27°C) and above; and each time a set of compression test specimens made.

4. Compression Test Specimen: ASTM C31; one set of 4 standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory cured test specimens.

5. Compressive Strength Tests: ASTM C39; one set for each day's pour exceeding 5 cu. yds. plus additional sets for each 25 cu. yds. over and above the first 25 cu. yds. of each concrete class placed in any one day; one specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required.

   When frequency of testing will provide less than 2 strength tests for a given class of concrete, conduct testing from each batch.

6. Acceptance of Concrete Strength:
   The concrete strength will be considered satisfactory if both the following requirements are met:

   A. Every arithmetic average of nay three consecutive strength tests equals or exceeds f'c.

   B. No individual strength test (average of two cylinders) falls below the f'c by more than 500 psi.

D. Test results will be reported in writing to Architect. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, compressive breaking strength and type of break for both 7-day tests and 28-day tests.

E. Additional Tests: The testing service will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Architect. Testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42, or by other methods as directed. Contractor shall pay for such tests conducted, and any other additional testing as may be required when unacceptable concrete is verified.

END OF SECTION 03 30 00

SECTION 03 30 01

CAST-IN-PLACE CONCRETE (SITE)

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete formwork.

B. Concrete reinforcement.

C. Joint devices associated with concrete work.

D. Miscellaneous concrete elements, including curb and gutter, sidewalks, equipment pads, light pole bases, thrust blocks, manholes, and other miscellaneous site improvements.

E. Concrete curing.

1.02 RELATED REQUIREMENTS

A. Section 32 13 13 - Concrete Paving: Site paving and slab on grade, sidewalks, curbs and gutters.

1.03 REFERENCE STANDARDS

A. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials; 2010.

B. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; 1991 (Reapproved 2009).

C. ACI 301 - Specifications for Structural Concrete; 2016.

D. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; 2000.

E. ACI 305R - Guide to Hot Weather Concreting; 2010.

F. ACI 306R - Cold Weather Concreting; 2010.

G. ACI 308R - Guide to Curing Concrete; 2001 (Reapproved 2008).

H. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2014 (Errata 2016).

I. ACI 347R - Guide to Formwork for Concrete; 2014.

J. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2016.

K. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2017.

L. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete; 2012.

M. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2016.

N. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2016b.

O. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2016a.

P. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens); 2016a.

Q. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2015a.

R. ASTM C150/C150M - Standard Specification for Portland Cement; 2016.

S. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method; 2016.

T. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2010a (Reapproved 2016).

U. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2015.

V. ASTM C685/C685M - Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing; 2014.

W. ASTM C881/C881M - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete; 2015.

X. ASTM C1059/C1059M - Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete; 2013.

Y. ASTM C1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures; 2015.

Z. ASTM D994/D994M - Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type); 2011 (Reapproved 2016).

AA. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types); 2004 (Reapproved 2013).

1.04 SUBMITTALS

A. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.

B. Mix Design: Submit proposed concrete mix design.

C. Test Reports: Submit report for each test or series of tests specified.

1.05 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 301 and ACI 318.

B. Follow recommendations of ACI 305R when concreting during hot weather.

C. Follow recommendations of ACI 306R when concreting during cold weather.

PART 2 PRODUCTS

2.01 FORMWORK

A. Form Materials: Contractor's choice of standard products with sufficient strength to withstand hydrostatic head without distortion in excess of permitted tolerances.
   1. Form Coating: Release agent that will not adversely affect concrete or interfere with application of coatings.
   2. Form Ties: Cone snap type that will leave no metal within 1-1/2 inches of concrete surface.

2.02 REINFORCEMENT MATERIALS

A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi).
   1. Type: Deformed billet-steel bars.
   2. Finish: Unfinished, unless otherwise indicated.
   3. Finish: Epoxy coated in accordance with ASTM A775/A775M, unless otherwise indicated.

B. Steel Welded Wire Reinforcement (WWR): Galvanized, plain type, ASTM A1064/A1064M.
   1. Form: Coiled Rolls.
   2. WWR Style: 4 x 8-W6 x W10.

C. Reinforcement Accessories:
   1. Tie Wire: Annealed, minimum 16 gage, 0.0508 inch.
   2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.

2.03 CONCRETE MATERIALS

A. Cement: ASTM C150/C150M, Type I - Normal Portland type.
   1. Acquire cement for entire project from same source.

B. Fine and Coarse Aggregates: ASTM C33/C33M.
   1. Acquire aggregates for entire project from same source.

C. Fly Ash: ASTM C618, Class C or F.

D. Calcined Pozzolan: ASTM C618, Class N.

E. Silica Fume: ASTM C1240, proportioned in accordance with ACI 211.1.

F. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to concrete.

2.04 BONDING AND JOINTING PRODUCTS

A. Latex Bonding Agent: Non-redispersible acrylic latex, complying with ASTM C1059/C1059M, Type II.

B. Epoxy Bonding System:
   1. Complying with ASTM C881/C881M and of Type required for specific application.

C. Slab Isolation Joint Filler: 1/2 inch thick, height equal to slab thickness, with removable top section that will form 1/2 inch deep sealant pocket after removal.

D. Slab Contraction Joint Device: Preformed linear strip intended for pressing into wet concrete to provide straight route for shrinkage cracking.

2.05 CONCRETE MIX DESIGN

A. Normal Weight Concrete:
   1. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: 3,000 pounds per square inch.
   2. Fly Ash Content: Maximum 15 percent of cementitious materials by weight.
   3. Calcined Pozzolan Content: Maximum 10 percent of cementitious materials by weight.
   4. Silica Fume Content: Maximum 5 percent of cementitious materials by weight.
   5. Water-Cement Ratio: Maximum 40 percent by weight.
   6. Total Air Content: 4 percent, determined in accordance with ASTM C173/C173M.
   7. Maximum Slump: 3 inches.
   8. Maximum Aggregate Size: 5/8 inch.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify lines, levels, and dimensions before proceeding with work of this section.

3.02 PREPARATION

A. Formwork: Comply with requirements of ACI 301. Design and fabricate forms to support all applied loads until concrete is cured, and for easy removal without damage to concrete.

B. Verify that forms are clean and free of rust before applying release agent.

C. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.

D. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning and applying bonding agent in according to bonding agent manufacturer's instructions.
   1. Use epoxy bonding system for bonding to damp surfaces, for structural load-bearing applications, and where curing under humid conditions is required.
   2. Use latex bonding agent only for non-load-bearing applications.

3.03 INSTALLING REINFORCEMENT AND OTHER EMBEDDED ITEMS

A. Fabricate and handle epoxy-coated reinforcing in accordance with ASTM D3963/D3963M.

B. Comply with requirements of ACI 301. Clean reinforcement of loose rust and mill scale, and accurately position, support, and secure in place to achieve not less than minimum concrete coverage required for protection.

C. Install welded wire reinforcement in maximum possible lengths, and offset end laps in both directions. Splice laps with tie wire.

D. Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with concrete placement.

3.04 PLACING CONCRETE

A. Place concrete in accordance with ACI 304R.

3.05 SLAB JOINTING

A. Locate joints as indicated on drawings.

B. Anchor joint fillers and devices to prevent movement during concrete placement.

C. Isolation Joints: Use preformed joint filler with removable top section for joint sealant, total height equal to thickness of slab, set flush with top of slab.

D. Saw Cut Contraction Joints: Saw cut joints before concrete begins to cool, within 4 to 12 hours after placing; use 3/16 inch thick blade and cut at least 1 inch deep but not less than one quarter (1/4) the depth of the slab.

E. Contraction Joint Devices: Use preformed joint device, with top set flush with top of slab.

F. Construction Joints: Where not otherwise indicated, use metal combination screed and key form, with removable top section for joint sealant.

3.06 CONCRETE FINISHING

A. Refer to Section 32 1313 Concrete Paving for additional requirements.

B. Repair surface defects, including tie holes, immediately after removing formwork.

C. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains at 1:100 nominal.

3.07 CURING AND PROTECTION

A. Comply with requirements of ACI 308R. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

3.08 FIELD QUALITY CONTROL

A. Refer to Section 32 1313 Concrete Paving for additional requirements.

3.09 DEFECTIVE CONCRETE

A. Test Results: The testing agency shall report test results in writing to Engineer and Contractor within 24 hours of test.

B. Defective Concrete: Concrete not complying with required lines, details, dimensions, tolerances or specified requirements.

C. Repair or replacement of defective concrete will be determined by the Engineer. The cost of additional testing shall be borne by Contractor when defective concrete is identified.

END OF SECTION 03 30 01

DIVISION 03 00 00: CONCRETE
Section 03 39 50: Sealer-Hardener for Concrete Floors

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Single application sealer-hardener for concrete floors.

B. Precautions for avoiding staining concrete before and after application.

1.2 RELATED SECTIONS

A. Section 03 30 00 - Cast-In-Place Concrete.

1.3 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Product Data: Manufacturer's data sheets, including product specifications, test data, preparation instructions and recommendations, storage and handling requirements and recommendations, and installation methods.

C. Maintenance instructions, including precautions for avoiding staining after application.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Applicator experienced with installation of product and certified by manufacturer, or applicator experienced with similar products and providing manufacturer's field technician on site to advise on application procedures; and providing adequate number of skilled workers trained and familiar with application requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver product in factory numbered and sealed drums, with numbers recorded for Owner's records.

B. Store products in manufacturer's unopened drums until ready for installation.

1.6 PROJECT CONDITIONS

A. No satisfactory procedures are available to remove petroleum or rust stains from concrete. Prevention is therefore essential. Take precautions to prevent staining of concrete prior to application of sealer-hardener and for minimum of three months after application:
   1. Prohibit parking of vehicles on concrete slab.
   2. If vehicles must be temporarily parked on slab, place drop cloths under vehicles during entire time parked.
   3. If construction equipment must be used for application, diaper all components that might drip oil, hydraulic fluid, or other liquids.
   4. Prohibit pipe cutting using pipe cutting machinery on concrete slab.
   5. Prohibit temporary placement and storage of steel members on concrete slab.

B. Do not install products under environmental conditions outside manufacturer's absolute limits.

C. Do not use frozen material; thaw and agitate prior to use.

1.7 WARRANTY

A. Provide manufacturer's warranty that a structurally sound concrete surface prepared and treated according to the manufacturer's directions will remain permanently dustproof, hardened and water repellent. If after the specified sealing period the treated surface does not remain dustproof, hardened and water repellent, provide, at manufacturer's expense, sufficient material to reseal defective areas.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Ashford Formula, by Curecrete (800-998-5664) – basis of design or approved equal.

B. Requests for substitutions will be considered in accordance with provisions of the General Conditions.

2.2 MATERIALS

A. Sealer-Hardener: Ashford Formula (basis of design); water-based chemically-reactive penetrating sealer and hardener, that seals by densifying concrete so that water molecules cannot pass through but air and water vapor can, while allowing concrete to achieve full compressive strength, minimizing surface crazing, and eliminating dusting.
   1. Colorless, transparent, odorless, non-toxic, non-flammable.
   2. Containing no solvents or volatile organic compounds.
   3. USDA approved for food handling facilities.
   4. Allowing traffic on floors within 2 to 3 hours, with chemical process complete within 3 months.
   5. No change to surface appearance except a sheen developed due to traffic and cleaning.

B. Water: Clean, potable.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly cured, prepared and are suitable for application of product.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. If this is the applicator's first project using this product, provide the manufacturer's technical representative on-site to familiarize installers with proper procedures.

C. Prevent damage to and soiling of adjacent work.

D. Concrete: Apply sealer-hardener only to clean bare concrete.
1. Ensure concrete is properly cured prior to application, follow manufacturer's recommendations.
2. Saturate surface with sealer-hardener; respray or broom excess onto dry spots.
3. Keep surface wet with sealer-hardener for minimum soak-in period of 30 to 40 minutes.
4. If, after the 30 minute soak-in period, most of the material has been absorbed, remove all excess material using broom or squeegee, especially from low spots.
5. If, after the 30 minute soak-in period, most of the material remains on the surface, wait until it becomes slippery and then flush entire surface with water removing all residue of sealer-hardener and squeegee completely dry, flushing any remaining slippery areas until no residue remains.
6. If water is not available, remove residue using squeegee.

3.4 PROTECTION

A. Protect installed floors until chemical reaction process is complete**.**
1. Comply with precautions listed under PROJECT CONDITIONS.
2. Clean floor regularly in accordance with manufacturer's recommendations because water will accelerate the sealing and scrubbing will impart a shine.
3. Clean up spills immediately and spot-treat stains with good degreaser or oil emulsifier.

B. Precautions and cleaning are the responsibility of the General Contractor until Final Acceptance by the Owner.

END OF SECTION 03 39 50

DIVISION 04 00 00: MASONRY
Section 04 20 00: Unit Masonry

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Concrete unit masonry. This Section is included in the contract documents specifically for concrete masonry infill, patching, pointing up and new walls as shown on the drawings and as required for project completion.

B. Related Sections: The following sections contain requirements that relate to this Section:

1. Division 7 Section "Flashing and Sheet Metal" for exposed sheet metal flashing installed in masonry.

C. Products installed but not furnished under this Section include the following:

1. Wood nailers and blocking built into unit masonry are specified in Division 6 Section "Rough Carpentry."
2. Reglets in masonry joints for metal flashing are specified in Division 7 Section "Flashing and Sheet Metal."
3. Hollow metal frames in unit masonry openings are specified in Division 8 Section "Steel Doors and Frames."

1.3 SYSTEM PERFORMANCE REQUIREMENTS

A. Provide unit masonry that develops the following installed compressive strengths (f'm):

1. For concrete unit masonry: As follows:

a. f'm = 1500 psi.

1.4 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract.

B. Shop drawings for reinforcing detailing fabrication, bending, and placement of unit masonry reinforcing bars. Comply with ACI 315 "Details and Detailing of Concrete Reinforcing" showing bar schedules, stirrup spacing, diagrams of bent bars, and arrangement of masonry reinforcement.

1.5 QUALITY ASSURANCE

A. Unit Masonry Standard: Comply with ACI 530.1/ASCE 6 "Specifications for Masonry Structures," except as otherwise indicated.

1. Revise ACI 530.1/ASCE 6 to exclude Sections 1.4 and 1.7; Parts 2.1.2, 3.1.2, and 4.1.2; and Articles 1.5.1.2, 1.5.1.3, 2.1.1.1, 2.1.1.2, and 2.3.3.9 and to modify Article 2.1.1.4 by deleting requirement for installing vent pipes and conduits built into masonry.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver masonry materials to project in undamaged condition.

B. Store and handle masonry units off the ground, under cover, and in a dry location to prevent their deterioration or damage due to moisture, temperature changes, contaminants, corrosion, and other causes. If units become wet, do not place until units are in an air-dried condition.

C. Store cementitious materials off the ground, under cover, and in dry location.

D. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

E. Store masonry accessories including metal items to prevent corrosion and accumulation of dirt and oil.

1.7 PROJECT CONDITIONS

A. Protection of Masonry: During erection, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.
2. Where one wythe of multi-wythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Remove immediately any grout, mortar, and soil that comes in contact with such masonry.

1. Protect base of walls from rain-splashed mud and mortar splatter by means of coverings spread on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes from mortar droppings.

D. Cold-Weather Construction: Comply with referenced unit masonry standard for cold-weather construction and the following:

1. Do not lay masonry units that are wet or frozen.
2. Remove masonry damaged by freezing conditions.

E. Hot-Weather Construction: Comply with referenced unit masonry standard.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Comply with referenced unit masonry standard and other requirements specified in this Section applicable to each material indicated.

2.2 CONCRETE MASONRY UNITS

A. General: Comply with requirements indicated below applicable to each form of concrete masonry unit required.

1. Provide special shapes where indicated and as follows:

a. For lintels, corners, jambs, sash, control joints, headers, bonding, and other special conditions.

2. Size: Provide concrete masonry units complying with requirements indicated below for size that are manufactured to specified face dimensions within tolerances specified in the applicable referenced ASTM specification for concrete masonry units.

a. Concrete Masonry Units: Manufactured to specified dimensions of 3/8 inch less than nominal widths by nominal heights by nominal lengths indicated on drawings.

B. Hollow Load-Bearing Concrete Masonry Units: ASTM C 90, Grade N and as follows:

1. Unit Compressive Strength: Provide units with minimum average net area compressive strength indicated below:

a. Not less than the unit compressive strengths required to produce concrete unit masonry construction of compressive strength indicated.

2. Weight Classification: Normal weight.

2.25 CLAY UNIT MASONRY

A. General: Comply with the following requirements applicable to each form of brick required:

1. Provide units without cores or frogs and with all exposed surfaces finished for ends of sills, caps, and similar applications that expose brick surfaces that otherwise would be concealed from view.

B. Face Brick Standard: ASTM C 216 and as follows:

1. Grade and Unit Compressive Strength: Provide units of grade and minimum average net area compressive strength indicated below:

a. Grade MW or SW.
b. Not less than the unit compressive strengths required to produce clay masonry construction of compressive strength indicated.

2. Type FBS.

3. Size: Provide bricks manufactured to the following actual dimensions within the tolerances specified in ASTM C 216:

4. Application: Use where brick is exposed, unless otherwise indicated.

5. Match existing brick in size, texture, color, and appearance.

2.4 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce required mortar color.

B. Masonry Cement: ASTM C 91.

C. Ready-Mixed Mortar: Cementitious materials, water, and aggregate complying with requirements specified in this article, combined with set-controlling admixtures to produce a ready-mixed mortar complying with ASTM C 1142.

D. Hydrated Lime: ASTM C 207, Type S.

E. Aggregate for Mortar: ASTM C 144, except for joints less than 1/4 inch use aggregate graded with 100 percent passing the No. 16 sieve.

F. Aggregate for Grout: ASTM C 404.

G. Water: Clean and potable.

2.5 REINFORCING STEEL

A. General: Provide reinforcing steel complying with requirements of referenced unit masonry standard and this article.

B. Steel Reinforcing Bars: Material and grade as follows:

1. Billet steel complying with ASTM A 615.
2. Grade 60.

C. Deformed Reinforcing Wire: ASTM A 496.

D. Plain Welded Wire Fabric: ASTM A 185.

E. Deformed Welded Wire Fabric: ASTM A 497.

2.6 JOINT REINFORCEMENT

A. General: Provide joint reinforcement complying with requirements of referenced unit masonry standard and this article, formed from the following:

1. Galvanized carbon steel wire, coating class as required by referenced unit masonry standard for application indicated.

B. Description: Welded-wire units prefabricated with deformed continuous side rods and plain cross rods into straight lengths of not less than 10 feet, with prefabricated corner and tee units, and

complying with requirements indicated below:

1. Wire Diameter for Side Rods: 0.1483 inch (9 gage).
2. Wire Diameter for Cross Rods: 0.1483 inch (9 gage).
3. For single-wythe masonry provide type as follows with single pair of side rods:

    a. Truss design with continuous diagonal cross rods spaced not more than 16 inches o.c.

4. For multiwythe masonry provide type as follows:

    a. Truss design with diagonal cross rods spaced not more than 16 inches o.c. and number of side rods as follows:

        1) Number of Side Rods for Multi-Wythe Concrete Masonry: One side rod for each face shell of hollow masonry units more than 4 inches in nominal width plus one side rod for each wythe of masonry 4 inches or less in nominal width.

    b. Tab design with single pair of side rods and rectangular box-type cross ties spaced not more than 16 inches o.c.; with side rods spaced for embedment within each face shell of backup wythe and ties extended to engage the outer wythe by at least 1-1/2 inches.

2.7 TIES AND ANCHORS, GENERAL

A. General: Provide ties and anchors specified in subsequent articles that comply with requirements for metal and size of referenced unit masonry standard and of this article.

B. Galvanized Carbon Steel Wire: ASTM A 82, coating class as required by referenced unit masonry standard for application indicated.

1. Wire Diameter: 0.1875 inch.

C. Steel Plates and Bars: ASTM A 36, hot-dip galvanized to comply with ASTM A 123 or ASTM A 153, Class B3, as applicable to size and form indicated.

2.8 BENT WIRE TIES

A. Individual units prefabricated from bent wire to comply with requirements indicated below:

B. Tie Shape for Hollow Masonry Units Laid with Cells Vertical: Rectangular with closed ends and not less than 4 inches wide.

C. Type for Masonry where Coursing between Wythes Align: Unit ties bent from one piece of wire.

2.9 ADJUSTABLE ANCHORS FOR CONNECTING MASONRY TO STRUCTURAL FRAMEWORK

A. General: Two-piece assemblies as described below allowing vertical or horizontal differential movement between wall and framework parallel to plane of wall, but resisting tension and compression forces perpendicular to it.

B. For anchorage to concrete framework, provide manufacturer's standard with dovetail anchor section formed from sheet metal and triangular-shaped wire tie section sized to extend within 1

inch of masonry face and as follows:

C. For anchorage to steel framework provide manufacturer's standard anchors with crimped 1/4-inch-diameter wire anchor section for welding to steel and triangular-shaped wire tie section sized to extend within 1 inch of masonry face and as follows:

1. Wire Diameter: 0.1875 inch.

2.10 MISCELLANEOUS ANCHORS

A. Unit Type Masonry Inserts in Concrete: Cast iron or malleable iron inserts of type and size indicated.

B. Dovetail Slots: Furnish dovetail slots, with filler strips, of slot size indicated, fabricated from 0.0336-inch (22-gage) sheet metal.

C. Anchor Bolts: Steel bolts complying with A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153, Class C; of diameter and length indicated and in the following configurations:

1. Headed bolts.

2.11 POSTINSTALLED ANCHORS

A. Anchors as described below, with capability to sustain, without failure, load imposed within factors of safety indicated, as determined by testing per ASTM E 488, conducted by a qualified independent testing laboratory.

1. Type: Chemical anchors.
2. Corrosion Protection: Carbon steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5 (5 microns) for Class SC 1 service condition (mild).
3. For cast-in-place and post-installed anchors in concrete: Capability to sustain, without failure, a load equal to 4 times loads imposed by masonry.
4. For post-installed anchors in grouted concrete masonry units: Capability to sustain, without failure, a load equal to 6 times loads imposed by masonry.

2.12 EMBEDDED FLASHING MATERIALS

A. Sheet Metal Flashing: Fabricate from the following metal complying with requirements specified in Division 7 Section "Flashing and Sheet Metal" and below:

1. Fabricate through-wall metal flashings embedded in masonry as follows:

a. With ribs formed in dovetail pattern at 3-inch intervals along length of flashing to provide a three-way integral mortar bond and weep-hole drainage.

2. Fabricate metal expansion joint strips from sheet metal indicated above, formed to shape indicated.
3. Application: Use where flashing is partly concealed in masonry wall.

B. Vinyl Sheet Flashing: Flexible sheet flashings especially formulated from virgin polyvinyl chloride with plasticizers and other modifiers to remain flexible and waterproof in concealed masonry applications, black in color and of thickness indicated below:

1. Thickness: 20 mils.
2. Application: Use where flashing is fully concealed in masonry.

C. Solder and Sealants for Sheet Metal Flashings: As specified in Division 7 section "Flashing and Sheet Metal."

2.13 MISCELLANEOUS MASONRY ACCESSORIES

A. Nonmetallic Expansion Joint Strips: Pre-molded filler strips complying with ASTM D 1056, Type 2 (closed cell), Class A (cellular rubber and rubber-like materials with specific resistance to petroleum base oils), Grade 1 (compression-deflection range of 2-5 psi), compressible up to 35 percent, of width and thickness indicated, formulated from the following material:

1. Neoprene.

B. Preformed Control Joint Gaskets: Material as indicated below, designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

1. Styrene-Butadiene Rubber Compound: ASTM D 2000, Designation 2AA-805.

C. Bond Breaker Strips: Asphalt-saturated organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

D. Weep Holes: Provide the following:

1. Plastic Weep Hole/Vent: One-piece flexible extrusion manufactured from ultraviolet-resistant polypropylene co-polymer, designed to weep moisture in masonry cavity to exterior, sized to fill head joints with outside face held back 1/8 inch from exterior face of masonry, in color selected from manufacturer's standards.

2.14 MASONRY CLEANERS

A. Job-Mixed Muriatic Solution: Solution of 1 part muriatic acid and 10 parts clean water, mixed in a nonmetallic container with acid added to water.

2.15 MORTAR AND GROUT MIXES

A. General: Do not add admixtures including coloring pigments, air-entraining agents, accelerators, retarders, water repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.

B. Mortar for Unit Masonry: Comply with ASTM C 270, Property Specification for job-mixed mortar and ASTM C 1142 for ready-mixed mortar, of types indicated below:

1. Limit cementitious materials in mortar to Portland cement-lime.
2. For masonry below grade and in contact with earth, and where indicated, use type indicated below:
   a. Type S.
3. For reinforced masonry and where indicated, use type indicated below:
   a. Type S.

4. For exterior, above-grade load-bearing and non-load bearing walls and parapet walls; for interior load-bearing walls; for interior non-load bearing partitions, and for other applications where another type is not indicated, use type indicated below:
   a. Type N.

C. Grout for Unit Masonry: Comply with ASTM C 476 and referenced unit masonry standard.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other specific conditions, and other conditions affecting performance of unit masonry.

B. Examine rough-in and built-in construction to verify actual locations of piping connections prior to installation.

C. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Comply with referenced unit masonry standard and other requirements indicated applicable to each type of installation included in Project.

B. Thickness: Build cavity and composite walls and other masonry construction to the full thickness shown. Build single-wythe walls to the actual thickness of the masonry units, using units of nominal thickness indicated.

C. Build chases and recesses as shown or required to accommodate items specified in this and other Sections of the Specifications. Provide not less than 8 inches of masonry between chase or recess and jamb of openings and between adjacent chases and recesses.

D. Leave openings for equipment to be installed before completion of masonry. After installation of equipment, complete masonry to match construction immediately adjacent to the opening.

E. Cut masonry units with motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide continuous pattern and to fit adjoining construction. Use full-size units without cutting where possible.

3.3 CONSTRUCTION TOLERANCES

A. Comply with construction tolerances of referenced unit masonry standard.

3.4 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint widths and for accurate locating of openings, movement-type joints, returns, and offsets. Avoid the use of less-than-half-size units at corners, jambs, and where possible at other locations.

B. Lay up walls to comply with specified construction tolerances, with courses accurately spaced and coordinated with other construction.

C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2 inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

D. Stopping and Resuming Work: In each course, rack back 1/2-unit length for one-half running bond or 1/3-unit length for one-third running bond; do not tooth. Clean exposed surfaces of set masonry, wet clay masonry units lightly (if required), and remove loose masonry units and mortar prior to laying fresh masonry.

E. Built-In Work: As construction progresses, build-in items specified under this and other Sections of the Specifications. Fill in solidly with masonry around built-in items.

1. Fill space between hollow metal frames and masonry solidly with mortar, unless otherwise indicated.

2. Fill cores in hollow concrete masonry units with grout 3 courses (24 inches) under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

3.5 MORTAR BEDDING AND JOINTING

A. Lay hollow concrete masonry units as follows:

1. With full mortar coverage on horizontal and vertical face shells.
2. Bed webs in mortar in starting course on footings and in all courses of piers, columns, and pilasters, and where adjacent to cells or cavities to be filled with grout.
3. For starting course on footings where cells are not grouted, spread out full mortar bed including areas under cells.

B. Cut joints flush for masonry walls to be concealed or to be covered by other materials, unless otherwise indicated.

3.6 CAVITIES/AIR SPACES

A. Keep cavities/air spaces clean of mortar droppings and other materials during construction. Strike joints facing cavities/air spaces flush.

B. Install vents in vertical head joints at the top of each continuous cavity/air space. Space vents and close off cavities/air spaces vertically and horizontally with blocking in manner indicated.

3.7 HORIZONTAL JOINT REINFORCEMENT

A. General: Provide continuous horizontal joint reinforcement as indicated. Install longitudinal side rods in mortar for their entire length with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcing a minimum of 6 inches.

B. Cut or interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.

C. Provide continuity at corners and wall intersections by use of prefabricated "L" and "T" sections. Cut and bend reinforcement units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.8 ANCHORING MASONRY TO STRUCTURAL MEMBERS

A. Anchor masonry to structural members where masonry abuts or faces structural members to comply with the following:

1. Provide an open space not less than 1 inch in width between masonry and structural member, unless otherwise indicated. Keep open space free of mortar or other rigid materials.
2. Anchor masonry to structural members with flexible anchors embedded in masonry joints and attached to structure.
3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.9 ANCHORING SINGLE-WYTHE MASONRY VENEER

A. Anchor single-wythe masonry veneer to metal studs with masonry veneer anchors to comply with the following requirements:

1. Fasten each anchor section through sheathing to metal studs with 2 metal fasteners of type indicated.
2. Locate anchor section relative to course in which tie section is embedded to allow maximum vertical differential movement of tie up and down.
3. Space anchors as indicated but not more than 18 inches o.c. vertically and 24 inches o.c. horizontally with not less than one anchor for each 2 sq. ft. of wall area. Install additional anchors within 1'-0" of openings and at intervals around perimeter not exceeding 8 inches.

B. Install vents at the top of each continuous air space in masonry veneer walls.

3.10 MOVEMENT (CONTROL AND EXPANSION) JOINTS

A. General: Install control and expansion joints in unit masonry where indicated. Build in related items as the masonry progresses. Do not form a continuous span through movement joints unless provisions are made to prevent in-plane restraint of wall or partition movement.

B. Form control joints in concrete masonry as follows:

1. Install preformed control joint gaskets designed to fit standard sash block.

3.11 LINTELS

A. Provide masonry lintels where shown and wherever openings of more than 1'-0" for brick size units and 2'-0" for block size units are shown without structural steel or other supporting lintels. Provide precast or formed-in-place masonry lintels. Cure precast lintels before handling and installation. Temporarily support formed-in-place lintels.

1. For hollow concrete masonry unit walls, use specially formed bond beam units with reinforcement bars placed as indicated and filled with coarse grout.

B. Provide minimum bearing of 8 inches at each jamb, unless otherwise indicated.

3.12 FLASHING/WEEP HOLES

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to the downward flow of water in the wall, and where indicated.

B. Prepare masonry surfaces so that they are smooth and free from projections that could puncture flashing. Place through-wall flashing on sloping bed of mortar and cover with mortar. Seal penetrations in flashing with adhesive/sealant/tape as recommended by flashing manufacturer before covering with mortar.

C. Install flashings as follows:

1. At lintels and shelf angles, extend flashing a minimum of 4 inches into masonry at each end. Extend flashing from exterior face of outer wythe of masonry, through the outer wythe, turned up a minimum of 4 inches, and through the inner wythe to within 1/2 inches of the interior face of the wall in exposed masonry. Where interior surface of inner wythe is concealed by furring, carry flashing completely through the inner wythe and turn up approximately 2 inches, unless otherwise indicated.
2. At heads and sills, extend flashing as specified above unless otherwise indicated but turn up ends not less than 2 inches to form a pan.
3. Interlock end joints of ribbed sheet metal flashings by overlapping ribs not less than 1-1/2 inches or as recommended by flashing manufacturer and seal lap with elastomeric sealant complying with requirements of Division 7 Section "Joint Sealers" for application indicated.
4. Turn down sheet metal flashings at exterior face of masonry to form drip.
5. Cut off flashing flush with face of wall after masonry wall construction is completed.

D. Install weep holes in the head joints in exterior wythes of the first course of masonry immediately above embedded flashings and as follows:

1. Form weep holes with product specified in Part 2 of this Section.
2. Space weep holes 24 inches o.c.

3.13 INSTALLATION OF REINFORCED UNIT MASONRY

A. General: Install reinforced unit masonry to comply with requirements of referenced unit masonry standard.

B. Temporary Formwork: Construct formwork and shores to support reinforced masonry elements during construction.

1. Construct formwork to conform to shape, line, and dimensions shown. Make sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.

C. Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist grout pressure.

D. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.

3.14 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or if units do not match adjoining units. Install new units to match adjoining units and in fresh mortar or grout, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge any voids or holes, except weep holes, and completely fill with mortar. Point-up all joints including corners, openings, and adjacent

construction to provide a neat, uniform appearance, prepared for application of sealants.

C. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave 1/2 panel unclean for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
4. Wet wall surfaces with water prior to application of cleaners; remove cleaners promptly by rinsing thoroughly with clear water.

5. Clean concrete masonry by means of cleaning method indicated in NCMA TEK 45 applicable to type of stain present on exposed surfaces.

D. Protection: Provide final protection and maintain conditions, in a manner acceptable to Installer, that ensure unit masonry is without damage and deterioration at time of Final Acceptance.

END OF SECTION 04 20 00

DIVISION 4: MASONRY
Section 04 70 00: Manufactured Stone

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Manufactured Stone Veneer.

B. Manufactured Stone Accessories.

1.2 RELATED SECTIONS

A. Section 06100 - Rough Carpentry: Wall framing and blocking for stone veneer application.

B. Section 07600 - Sheet Metal Flashing and Trim: Weep screeds and wall and roof flashings.

C. Section 07901 - Joint Sealants: Sealers for treating gaps and penetrations.

1.3 REFERENCES

A. American Concrete Institute (ACI).

B. ASTM C 39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

C. ASTM C 67 - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile.

D. ASTM C 177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.

E. ASTM C 192 - Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory.

F. ASTM C 270 - Standard Specification for Mortar for Unit Masonry.

G. ASTM C 482 - Standard Test Method for Bond Strength of Ceramic Tile to Portland Cement.

H. ASTM D 226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.

I. Underwriters Laboratories (UL): UL Listed.

1.4 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Color charts.
4. Installation methods.

C. Detail Drawings: Submit detail drawings depicting proper installation and flashing techniques. Coordinate locations with those found on the Contract Drawings.

D. Selection Samples: For each product specified, two samples representing manufacturer's product including textures and colors.

E. Verification Samples: For each finish product specified, two samples, minimum size 12 inches (305mm) square that depict the specified product, color, pattern and texture.

F. Quality Assurance / Product Control Submittals:
1. Proof of manufacturer qualifications as described in Article - Quality Assurance.
2. Proof of installer qualifications as described in Article - Quality Assurance.
3. Current ICC-ES Report.
4. Certification of compliance with all code bodies having jurisdiction.
5. Test Reports for physical properties upon request.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications:
1. Single manufacturer with at least five (5) years experience manufacturing and marketing all Manufactured Stone will provide all products in this section.
2. Manufacturer will be affiliated with MSJC, ACI and ASTM.

B. Installer Qualifications: Company with documented experience in installation of manufactured masonry including at least five (5) projects within a 400 mile (650km) radius of this Project.

C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
1. Installation areas to be designated by Architect.
2. Selected areas may be part of area to receive stone finish.
3. Do not proceed with remaining work until workmanship, color, laying pattern and grout are approved by Architect and / or others with approval authority.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of hazardous materials in accordance with requirements of local authorities having jurisdiction.

C. Prior to installation protect material from precipitation combined with freezing temperatures. Product with visible frozen moisture should not be installed.

1.7 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.8 WARRANTY

A. At project close-out, provide to the Owner an executed copy of the manufacturer's standard limited warranty against defects in manufacturing.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: ProVia Old Dominion (Basis of Design) , Eldorado, Coronado Stone or prior approved equivalent.

B. Requests for substitutions will be considered in accordance with provisions of Section 01600.

2.2 APPLICATION / SCOPE

A. The Work specified in this section is not designed to improve the load bearing capacity of a wall. Products should not be used under water, such as in swimming pools or other water features. To avoid discoloration, products should not be subjected to harsh chemicals such as chlorine, salts, or acids. Products are not designed for flat work such as patio areas that are subject to traffic.

B. Manufactured stone products are cast in uniquely designed molds to produce the texture of natural stone. Each product style is manufactured from a special blend of Portland cement, lightweight aggregates, and Iron oxide pigment to replicate the elegance of natural stone.

C. Manufactured stone's special blend of lightweight aggregates significantly reduce the effects of "freeze and thaw" while increasing the compression strength to levels above the industry standards.

2.3 TRIM STONES AND ACCESSORIES

A. Post and Wall Caps:
1. Shape: Tapered.

2.4 MORTAR

A. Pre Mixed Mortar: Complying with ASTM C 270:
1. Type: N.

2.5 RELATED MATERIALS

A. Wall Underlayment:
1. Weather Resistant Barrier meeting the requirements of ICC-ES AC-38

B. Metal Flashing:
1. 16 oz/sq ft (5 kg/sm) copper sheet; ASTM B 370.

2.6 MORTAR MIXES

A. Mix materials in accordance with manufacturer's instructions. Thoroughly mix mortar ingredients in quantities needed for immediate use in accordance with ASTM C 270.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 SURFACE PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Installations Over Open Studs:
   1. Apply paper-backed galvanized 3.4 lb. 3/8 inch (10mm) rib expanded metal lath to the studs using galvanized nails or staples every 6 inches (152mm) vertically on stud centers with a minimum penetration of 1 inch (25mm). Overlap lath sides no less than 1 inch (25mm) and ends no less than 1 inch (25mm).
   2. For metal studs use corrosion-resistant self tapping screws with a 3/8 inch (10mm) head which provides a minimum 1/2 inch (13mm) penetration beyond the inside metal surface.

D. Installations over Rigid Insulation Board:
   1. Cover the approved substrate with a weather resistant barrier. Lap joints by applying felt horizontally with the upper layer lapped over the lower layer not less than 2 inches (51mm) and end laps not less than 6 inches (152mm). Install specified metal lath in accordance with manufacturer's requirements. Use galvanized lath for exterior applications and black metal lath for interior applications.
   2. Lap lath sides not less than 1 inch (25mm) and end laps not less than 1 inch (25mm). Lath must be attached with the small diamonds pointing upwards. On inside and outside corners, overlap at least 16 inches (406mm) in each direction.
   3. Attach wire lath using 1 1/2 inch (38mm) minimum galvanized nails or Staples on 4 inch (102mm) centers penetrating each 16 inch (406 mm) on center wall stud a minimum of I inch (25mm).
   4. Apply a mortar scratch coat to cover the metal lath and apply the stone while the scratch coat is still moist. If the scratch coat dries before applying the stone, the scratch coat should be remoistened by spraying it with water.

3.3 INSTALLATION

A. Install Manufactured Stone in accordance with manufacturer's instructions.

3.4 PROTECTION

A. Seal manufactured stone products in areas of abnormal moisture contact and exposure to chemicals such as Magnesium Chloride (ice melt products). It is recommended using an impregnating breathable class of sealers, and applying per manufacture recommendation, in these areas of abnormal moisture exposure.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 04700

DIVISION 6 WOOD AND PLASTICS
SECTION 06 05 73 Pressure Treated Wood

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Preservative treatment of lumber and plywood.

1.2 RELATED SECTIONS

A. Section 06 10 00 - Rough Carpentry.

B. Section 06 13 00 – Heavy Timber Construction

1.3 REFERENCES

A. ASTM International (ASTM):
1. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
2. ASTM A653 / A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

B. American Wood-Protection Association (AWPA):
1. AWPA E12 - Standard Method of Determining the Corrosion of Metal in Contact with Wood.
2. AWPA M4 - Standard for the Care of Preservative Treated Wood Products.
3. AWPA P5 - Standard for Waterborne Preservatives.
4. AWPA P23 - Standard for Chromated Copper Arsenate Type C (CCA-C).
5. AWPA P25 - Standard for Inorganic Boron (SBX).
6. AWPA P26 - Standard for Alkaline Copper Quat Type A (ACQ-A).
7. AWPA P27 - Standard for Alkaline Copper Quat Type B (ACQ-B).
8. AWPA P28 - Standard for Alkaline Copper Quat Type C (ACQ-C).
9. AWPA P29 - Standard for Alkaline Copper Quat Type D (ACQ-D).
10. AWPA P47 - Standard for DCOI/Imidacloprid/Stabilizer, Waterborne (EL2).
11. AWPA P48 - Standard for Copper Azole Type C (CA-C).
12. AWPA T1 - Use Category System: Processing and Treatment Standard.
13. AWPA U1 - Use Category System: User Specification for Treated Wood.

C. Permanent Wood Foundation (PWF) Design Specification, ANSI/AF&PA PWF-2007.

D. Permanent Wood Foundations, Design and Construction Guide, Southern Pine Council. Publication #400.

E. Hawaiian Local Building Code Standards.

1.4 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Product Data: Manufacturer's instructions for use, including requirements for storage, cutting, and finishing.

C. Preservative Treatment Certification: Treating plant's certification of compliance with specified standards, process employed, and preservative retention values.

1.5 QUALITY ASSURANCE

A. Wood Treatment Plant Qualifications: Wood treatment plant experienced in performing work of this section.

B. Source Quality: Obtain treated wood products from a single approved source.

C. Preservative Treatment: Mark each piece of plywood and lumber to show compliance with specified standards.

D. Independent Third Party Inspection:
   1. Provide plant inspections.

E. Kiln Dry after Treatment (KDAT): Provide kiln dry material as indicated or required.
   1. Kiln dry after treatment to 19 percent maximum moisture content for lumber and 18 percent for plywood in accordance with AWPA T1, Section 7 - Drying After Treatment (lumber) and AWPA T1, Section :F: Pressure treated composites (3c) kiln drying after treatment.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Exposure: Prevent wood products against moisture and dimensional changes, in accordance with instructions from treating plant.

1.7 WARRANTY

A. Manufacturer's Warranty: Provide manufacturer's standard lifetime limited warranty for pressure treated wood.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Great Southern Wood, Viance, Wolmanized, Koppers Industries, Georgia Pacific, or approved equivalent.

B. Requests for substitutions will be considered in accordance with provisions of Section 01 25 13.

2.2 MATERIALS

A. Dimension Lumber: As specified in Section 06 10 00.

B. Structural Plywood: As specified in Section 06 10 00.

C. Fasteners and Metal Hardware In Preservative Treated Wood : For treated wood and where wood is in ground contact, subject to high relative humidity, or exposed to weather, provide corrosion resistant steel fasteners with hot-dip zinc coating per ASTM A153/A153M, provide corrosion resistant hardware per ASTM A653 / A653M Class G-185 in compliance with building code requirements and all manufacturers recommendations.

2.3 PRESERVATIVE PRESSURE TREATMENT OF WOOD

A. Preservative treatment for above ground use continuously protected from liquid water:
   1. Treatment: TimberSaver PT (SBX) in accordance with AWPA U1 and P5 and P25.
      a. For protection against North American subterranean termites, decay and insects, 0.25 lb/cu ft (4kg/m3) Disodium Octaborate Tetrahydrate (DOT) minimum retention (0.17 lb/cu ft (2.7 kg/m3) as B2O3 equivalent) retention.
      b. For protection against North America subterranean termites, Formosan termites and insects, use 0.42 lb/cu ft. (6.7 kg /m3) Disodium Octaborate Tetrahydrate

(DOT) minimum retention (0.28 lb/cu ft. (4.5 kg/m3) as B2O3 equivalent) in accordance with AWPA U1 or Hawaiian building code standards as appropriate.

c. All lumber and Plywood treated with TimberSaver PT shall be protected from exposure to the weather during transit and storage. TimberSaver PT treated products shall be stored out of ground contact and protected against exposure to liquid water.

2. Treatment: TimberSaver 40 (SBX) in accordance with AWPA U1 and P5 and P25.
   a. For protection against North American subterranean termites, Formosan termites and insects use 0.42 lb/cu ft. (6.7 kg /m3) Disodium Octaborate Tetrahydrate (DOT) minimum retention (0.28 lb/cu ft. (4.5 kg/m3) as B2O3 equivalent) in accordance with AWPA U1 or Hawaiian building code standards as appropriate.
   b. All lumber and Plywood treated with TimberSaver 40 shall be protected from exposure to the weather during transit and storage. TimberSaver 40 treated products shall be stored out of ground contact and protected against exposure to liquid water.
3. Treat wood in the following locations:
   a. All framing lumber, studs, sill plates, floor joists, roof rafters, trusses, plywood,
   b. Interior sheathing, furring strips, flooring, moldings and wood trim.

B. Preservative Treatment for Above Ground Use: decking, fencing, handrails, joists and subflooring, roof decks and sheathing.
1. Treatment: ACQ as manufactured for Viance in accordance with AWPA U1 and P5, P26, P27, P28, P29 as appropriate.
   a. Use 0.15 lb/cu ft (2.4 kg/m3) of ACQ in accordance with AWPA U1: (UC3B) as appropriate.
2. Treatment: Ecolife or EL2 as manufactured by Viance.
   a. Use 0.019 lb/cu ft (0.3 kg/m3) of Ecolife or EL2 (+ 0.2 lb/cu ft MCS) in accordance with AWPA U1 (UC3B) as appropriate.
3. Treat wood in the following locations:
   a. In contact with roofing, flashing, or waterproofing.
   b. In contact with masonry or concrete.
   c. Within 18 inches (450 mm) of grade.
   d. Exposed to weather.
   e. Other locations indicated.

C. Preservative Treatment, Ground and Fresh Water Contact: Fence posts, Landscaping, piers and docks.
1. Treatment: ACQ as manufactured for Viance in accordance with AWPA U1.
   a. Use 0.40 lb/cu ft (6.4 kg/m3) of ACQ in accordance with AWPA U1 (UC4A) as appropriate.
2. Use 0.40 lb/cu ft (6.4 kg/m3) retention.
3. If required, kiln dry after treatment to 19 percent maximum moisture content for lumber and 18 percent for plywood.
4. Treat wood in the following locations:
   a. In contact with ground.
   b. In contact with fresh water.
   c. Used as posts, landscaping timbers, retaining walls, piers, or docks.

D. Preservative Treatment for Wood Foundation Systems: Permanent wood foundations, crawl spaces.
1. Pressure-treat softwood lumber, timber, and plywood for wood foundation systems with waterborne preservatives to comply with AWPA U1.
2. Treatment: ACQ as manufactured for Viance in accordance with AWPA U1 (UC4B)
   a. Use 0.60 lb/cu ft (9.6 kg/m3) of ACQ in accordance with U1 or ESR 2644 as

appropriate.

2.4 CCA PRESERVATIVE PRESSURE TREATMENT OF WOOD

A. Preservative Treatment of lumber and plywood for Above Ground Use (UC3) in accordance with the U.S. EPA Supplemental label requirements for forest products treated with CCA:
   1. Treatment: CCA type C manufactured by CSI in accordance with AWPA U1, P5 and P23.
   2. Use 0.25 lb/cu ft (4 kg/m3) of CCA type C in accordance with AWPA U1.
   3. When required, kiln dry after treatment to 19 percent maximum moisture content for lumber and 18 percent for plywood recommended in accordance with AWPA T1 Section 7 - Drying After Treatment (lumber) and AWPA T1 Section F Pressure treated composites (3c) kiln drying after treatment.
   4. Treat wood for use in the following locations:
      a. In contact with roofing, flashing, or waterproofing.
      b. In contact with masonry or concrete.
      c. Within 18 inches (450 mm) of grade.
      d. Exposed to weather.
      e. Other locations indicated.

B. Preservative Treatment of lumber and plywood for Ground and Fresh Water Contact (UC4A) in accordance with the U.S. EPA Supplemental label requirements for forest products treated with CCA:
   1. Treatment: CCA type C manufactured by CSI in accordance with AWPA U1, P5 and P23.
   2. Use 0.40 lb/cu ft (6.4 kg/m3) of CCA type C retention in accordance with AWPA U1.
   3. When required, kiln dry after treatment to 19 percent maximum moisture content for lumber and 18 percent for plywood recommended in accordance with AWPA T1 Section 7 - Drying After Treatment (lumber) and AWPA T1 Section F Pressure treated composites (3c) kiln drying after treatment.
   4. Treat wood in the following locations:
      a. In contact with ground.
      b. In contact with fresh water.
      c. Used as posts, landscaping timbers, retaining walls, piers, or docks.

C. Preservative Treatment of lumber and plywood for Wood Foundation Systems UC4B in accordance with the U.S. EPA Supplemental label requirements for forest products treated with CCA:
   1. Pressure-treat softwood lumber, timber, and plywood for wood foundation systems with CCA type C manufactured by CSI in accordance with AWPA U1, P5 and P23.
      a. Use 0.60 lb/cu ft (9.6 kg/m3) retention of CCA type C to comply with AWPA U1

D. Preservative Treatment for Poles (UC4B) in accordance with the U.S. EPA Supplemental label requirements for forest products treated with CCA
   1. Pressure treat poles with CCA type C manufactured by CSI in accordance with AWPA U1, P5 and P23..
   2. Use 0.60 lb/cu ft (9.6 kg/m3) retention of CCA type C to comply with AWPA U1

E. Preservative Treatment of wood for fresh water and land round piles (UC4C) in accordance with the U.S. EPA Supplemental label requirements for forest products treated with CCA
   1. Pressure treat wood with CCA type C manufactured by CSI in accordance with AWPA U1, P5 and P23.
   2. Use 0.80 lb/cu ft (12.8 kg/m3) retention of CCA type C to comply with AWPA U1.

F. Preservative Treatment of wood for salt water immersion (Marine Use) (UC5) in accordance

with the U.S. EPA Supplemental label requirements for forest products treated with CCA

1. Pressure treat wood with CCA type C manufactured by CSI in accordance with AWPA U1, P5 and P23.
2. Use retentions of CCA type C appropriate for the marine exposure zone to comply with AWPA U1.

PART 3 EXECUTION

3.1 INSTALLATION

A. Framing and Sheathing: Comply with installation requirements in Section 06100.

B. Preservative Treated Wood:
   1. Surface treatment of field cuts: All field cuts on members that provide structural support to a permanent structure shall be field treated in accordance with AWPA M4.

C. Wood Foundation System: Install in accordance with the following:
   1. Permanent Wood Foundation (PWF) Design Specification, ANSI/AF&PA PWF-2007.
   2. Permanent Wood Foundations, Design and Construction Guide, Southern Pine Council. Publication #400.

END OF SECTION

SECTION 061000
ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Structural dimension lumber framing.

B. Nonstructural dimension lumber framing.

C. Rough opening framing for doors, windows, and roof openings.

D. Sheathing.

E. Subflooring.

F. Preservative treated wood materials.

G. Concealed wood blocking, nailers, and supports.

H. Miscellaneous wood nailers, furring, and grounds.

1.02 REFERENCE STANDARDS

A. ANSI A208.1 - American National Standard for Particleboard 2022.

B. ASTM D3498 - Standard Specification for Adhesives for Field-Gluing Wood Structural Panels (Plywood or Oriented Strand Board) to Wood Based Floor System Framing 2019a.

C. AWC (WFCM) - Wood Frame Construction Manual for One- and Two-Family Dwellings 2018, with Errata (2019).

D. AWPA U1 - Use Category System: User Specification for Treated Wood 2023.

E. ICC-ES AC380 - Acceptance Criteria for Termite Physical Barrier Systems 2021, with Editorial Revision (2022).

F. PS 2 - Performance Standard for Wood Structural Panels 2018.

G. PS 20 - American Softwood Lumber Standard 2021.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide technical data on insulated sheathing, wood preservative materials, and application instructions.

1.04 DELIVERY, STORAGE, AND HANDLING

A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, and installation.

1.05 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Correct defective work within a two-year period commencing on Date of Substantial Completion.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
   1. If no species is specified, provide species graded by the agency specified; if no grading agency is specified, provide lumber graded by grading agency meeting the specified requirements.
   2. Grading Agency: Grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee at www.alsc.org, and who provides grading

service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

A. Sizes: Nominal sizes as indicated on drawings, S4S.

B. Moisture Content: S-dry or MC19.

C. Stud Framing (2 by 2 through 2 by 6 (50 by 50 mm through 50 by 150 mm)):
   1. Species: Allowed under referenced grading rules.
   2. Grade: No. 2.

D. Joist, Rafter, and Small Beam Framing (2 by 6 through 4 by 16 (50 by 150 mm through 100 by 400 mm)):

E. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
   1. Lumber: S4S, No. 2 or Standard Grade.
   2. Boards: Standard or No. 3.

2.03 CONSTRUCTION PANELS

A. Roof Sheathing: PS 2 type, rated Structural I Sheathing.
   1. Bond Classification: Exterior.
   2. Span Rating: 60.
   3. Performance Category: 3/4 PERF CAT.

B. Wall Sheathing: Oriented strand board wood structural panel; PS 2.
   1. Grade: Structural 1 Sheathing.
   2. Bond Classification: Exposure 1.
   3. Performance Category: 5/8 PERF CAT.
   4. Span Rating: 40/20.
   5. Edges: Square.
   6. Exposure Time: Sheathing will not delaminate or require sanding due to moisture absorption from exposure to weather for up to 500 days.
   7. Provide fastening guide on top panel surface with separate markings indicating fastener spacing for 16 inches (406 mm) and 24 inches (610 mm) on center, respectively.
   8. Warranty: Manufacturer's standard lifetime limited warranty against manufacturing defects and that panels will not delaminate or require sanding due to moisture absorption damage from exposure to weather for up to the stated period.

2.04 ACCESSORIES

A. Joist Hangers: Hot dipped galvanized steel, sized to suit framing conditions.

B. Sill Gasket on Top of Foundation Wall: 1/4 inch (6 mm) thick, plate width, closed cell plastic foam from continuous rolls.

C. Termite-Resistant Sill Flashing: Self-adhesive membrane; polyethylene film bonded to sealant.
   1. Thickness: 40 mil, 0.040 inch (1 mm).
   2. Termite Resistance: 100 percent when tested in accordance with ICC-ES AC380.

D. Subfloor Adhesives: Gap-filling construction adhesive for bonding wood structural panels to wood-based floor system framing; complying with ASTM D3498.

2.05 FACTORY WOOD TREATMENT

A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
   1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.

2. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.

B. Preservative Treatment:
   1. Preservative Pressure Treatment of Lumber Above Grade: AWPA U1, Use Category UC3B, Commodity Specification A using waterborne preservative.
      a. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
      b. Treat lumber exposed to weather.

PART 3 EXECUTION

3.01 PREPARATION

A. Install sill gasket under sill plate of framed walls bearing on foundations; puncture gasket cleanly to fit tightly around protruding anchor bolts.

3.02 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.

B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.03 FRAMING INSTALLATION

A. Set structural members level, plumb, and true to line. Discard pieces with defects that would lower required strength or result in unacceptable appearance of exposed members.

B. Make provisions for temporary construction loads, and provide temporary bracing sufficient to maintain structure in true alignment and safe condition until completion of erection and installation of permanent bracing.

C. Install structural members full length without splices unless otherwise specifically detailed.

D. Comply with member sizes, spacing, and configurations indicated, and fastener size and spacing indicated, but not less than required by code.

E. Install horizontal spanning members with crown edge up and not less than 1-1/2 inches (38 mm) of bearing at each end.

F. Construct double joist headers at floor and ceiling openings and under wall stud partitions that are parallel to floor joists; use metal joist hangers unless otherwise detailed.

G. Provide bridging at joists in excess of 8 feet (2.3 m) span as detailed. Fit solid blocking at ends of members.

H. Frame wall openings with two or more studs at each jamb; support headers on cripple studs.

3.04 BLOCKING, NAILERS, AND SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to authorities having jurisdiction may be used in lieu of solid wood blocking.

C. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.

D. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.

E. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

F. Provide the following specific nonstructural framing and blocking:
   1. Cabinets and shelf supports.
   2. Wall brackets.
   3. Handrails.
   4. Grab bars.
   5. Towel and bath accessories.
   6. Wall-mounted door stops.
   7. Chalkboards and marker boards.
   8. Wall paneling and trim.
   9. Joints of rigid wall coverings that occur between studs.

3.05 ROOF-RELATED CARPENTRY

A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.

3.06 INSTALLATION OF CONSTRUCTION PANELS

A. Subflooring/Underlayment Combination: Glue and nail to framing; staples are not permitted.

B. Roof Sheathing: Secure panels with long dimension perpendicular to framing members, with ends staggered and over firm bearing.
   1. Nail panels to framing; staples are not permitted.

C. Wall Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using nails, screws, or staples.
   1. Use plywood or other acceptable structural panels at building corners, for not less than 96 inches (2440 mm), measured horizontally.
   2. Place water-resistive barrier horizontally over wall sheathing, weather lapping edges and ends.

3.07 SITE APPLIED WOOD TREATMENT

A. Apply preservative treatment compatible with factory applied treatment at site-sawn cuts, complying with manufacturer's instructions.

B. Allow preservative to dry prior to erecting members.

3.08 TOLERANCES

A. Framing Members: 1/4 inch (6 mm) from true position, maximum.

B. Surface Flatness of Floor: 1/8 inch in 10 feet (1 mm/m) maximum, and 1/4 inch in 30 feet (7 mm in 10 m) maximum.

C. Variation from Plane, Other than Floors: 1/4 inch in 10 feet (2 mm/m) maximum, and 1/4 inch in 30 feet (7 mm in 10 m) maximum.

3.09 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements for additional requirements.

3.10 CLEANING

A. Waste Disposal: See Section 017419 - Construction Waste Management and Disposal.
   1. Comply with applicable regulations.
   2. Do not burn scrap on project site.
   3. Do not burn scraps that have been pressure treated.
   4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or “waste-to-energy” facilities.

B. Do not leave wood, shavings, sawdust, etc. on the ground or buried in fill.

C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

SECTION 06 18 00
GLUED-LAMINATED CONSTRUCTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Glue laminated wood beams and purlins.

B. Preservative treatment of wood.

C. Fire retardant treatment of wood.

D. Steel hardware and attachment brackets.

1.02 RELATED REQUIREMENTS

A. Section 016116 - Volatile Organic Compound (VOC) Content Restrictions.

1.03 REFERENCE STANDARDS

A. AITC 117 - Standard Specifications for Structural Glued Laminated Timber of Softwood Species 2010.

B. AITC A190.1 - American National Standard for Wood Products - Structural Glued Laminated Timber 2007.

C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.

D. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.

E. ASTM D2898 - Standard Practice for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing 2010 (Reapproved 2017).

F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023a.

G. AWPA U1 - Use Category System: User Specification for Treated Wood 2023.

H. FM (AG) - FM Approval Guide Current Edition.

I. RIS (GR) - Standard Specifications for Grades of California Redwood Lumber 2019.

J. SPIB (GR) - Standard Grading Rules 2021.

K. UL (FRD) - Fire Resistance Directory Current Edition.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide technical data on wood preservative materials, application technique and resultant performance information.

C. Shop Drawings: Indicate framing system, sizes and spacing of members, loads and cambers, bearing and anchor details, bridging and bracing and framed openings.
   1. Submit design calculations signed and sealed by design engineer.

D. Designer's Qualification Statement.

E. Manufacturer's Qualification Statement.

1.05 QUALITY ASSURANCE

A. Designer Qualifications: Design structural members under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located.

B. Manufacturer/Fabricator Qualifications: Company specializing in manufacture of glue laminated structural units with three years of documented experience, and certified by AITC in accordance with AITC A190.1.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect members to AITC requirements for not wrapped.

B. Leave individual wrapping in place until finishing occurs.

C. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, or installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Glued-Laminated Structural Units:
   1. Boise Cascade Company; www.bc.com/#sle.
   2. Sentinel Structures, Inc: www.sentinelstructures.com/#sle.
   3. Western Wood Structures, Inc;: www.westernwoodstructures.com/#sle.
   4. Substitutions: See Section 016000 - Product Requirements.

B. Architectural Grade Glued-Laminated Columns:
   1. Boise Cascade Company: www.bc.com/#sle.
   2. Substitutions: See Section 016000 - Product Requirements.

2.02 GLUED-LAMINATED UNITS

A. Glued-Laminated Units: Fabricate in accordance with AITC 117 Industrial grade.
   1. Verify dimensions and site conditions prior to fabrication.
   2. Cut and fit members accurately to length to achieve tight joint fit.
   3. Fabricate member with camber built in.
   4. Do not splice or join members in locations other than those indicated without permission.
   5. After end trimming, seal with penetrating sealer in accordance with AITC requirements.

2.03 MATERIALS

A. Lumber: Softwood lumber complying with RIS (GR) grading rules with 12 percent maximum moisture content before fabrication. Design for the following values:

B. Steel Connections and Brackets: ASTM A36/A36M weldable quality, galvanize per ASTM A123/A123M.

C. Bearing Plate Anchors: Expansion shield and lag bolt type for anchorage to solid masonry or concrete.

2.04 WOOD TREATMENT

A. Factory-Treated Lumber: Comply with requirements of AWPA U1 - Use Category System for pressure impregnated wood treatments determined by use categories, expected service conditions, and specific applications.

B. Fire Retardant Treatment:
   1. Exterior Type: AWPA U1 Use Category UCFB, Commodity Specification H, chemically treated and pressure impregnated; maximum flame spread index of 25 when tested in accordance with ASTM E84 and with no evidence of significant combustion when test is extended for an additional 30 minutes both before and after accelerated weathering test performed in accordance with ASTM D2898.
      a. Kiln dry wood after treatment to a maximum moisture content of 19 percent prior to lamination.
   2. Interior Type A: AWPA U1, Use Category UCFA, Commodity Specification H, low temperature (low hygroscopic) type, chemically treated and pressure impregnated; maximum flame spread index of 25 when tested in accordance with ASTM E84 and with no evidence of significant combustion when test is extended for an additional 20 minutes.
      a. Kiln dry wood after treatment to a maximum moisture content of 19 percent prior to lamination.

b. Do not use treated wood in applications exposed to weather or where the wood may become wet.

C. Preservative Pressure Treatment:
1. Manufacturers:
a. Lonza Group: www.wolmanizedwood.com/#sle.
b. Osmose Utilities Services, Inc: www.osmose.com/#sle.
c. Viance, LLC: www.treatedwood.com/#sle.
d. Substitutions: See Section 016000 - Product Requirements.
2. Preservative Pressure Treatment of Glued-Laminated Structural Units: AWPA U1, Use Category UC3B, Commodity Specification F using waterborne preservative to 0.25 lb/cu ft retention (to 4.0 kg/cu m retention).
a. Kiln dry lumber after treatment and before lamination to maximum moisture content of 19 percent.

2.05 FABRICATION

A. Fabricate glue laminated structural members in accordance with AITC Industrial grade.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that supports are ready to receive units.

B. Verify sufficient end bearing area.

3.02 PREPARATION

A. Coordinate placement of bearing items.

3.03 ERECTION

A. Lift members using protective straps to prevent visible damage.

B. Set structural members level and plumb, in correct positions or sloped where indicated.

C. Provide temporary bracing and anchorage to hold members in place until permanently secured.

D. Fit members together accurately without trimming, cutting, splicing, or other unauthorized modification.

E. Swab and seal the interior wood surfaces of field drilled holes in members with primer.

3.04 TOLERANCES

A. Framing Members: 1/2 inch (12 mm) maximum from true position.

END OF SECTION

DIVISION 6: WOOD AND PLASTICS
Section 06 20 00: Finish Carpentry

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Interior standing and running trim and rails.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 6 Section "Rough Carpentry" for furring, blocking, and other carpentry work that is not exposed to view.
2. Division 6 Section "Interior Architectural Woodwork" for interior woodwork not specified in this Section.
3. Division 7 Section "Flashing and Sheet Metal" for flashing and other sheet metal work.
4. Division 7 Section "Joint Sealants" for sealants.
5. Division 9 Section "Painting" for back priming and finishing of finish carpentry.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract.

B. Product data for each type of factory-fabricated product and process specified, including details of construction relative to materials, dimensions of individual components, profiles, textures, and colors.

C. Wood treatment data as follows including chemical treatment manufacturer's instructions for handling, storing, installation, and finishing of treated material:

1. For each type of preservative treated wood product include certification by treating plant stating type of preservative solution and pressure process used, net amount of preservative retained, and compliance with applicable standards.
2. For water-borne treated products include statement that moisture content of treated materials was reduced to levels indicated prior to shipment to Project site.
3. For fire-retardant-treated wood products include certification by treating plant that treated materials comply with specified standard and other requirements.
4. Material test reports from qualified independent testing laboratory indicating and interpreting test results relative to compliance of fire-retardant-treated wood products with requirements indicated.
5. Warranty of chemical treatment manufacturer for each type of treatment.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Arrange for installation of finish carpentry by a firm that can demonstrate successful experience in installing finish carpentry items similar in type and quality to those

required for this Project.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Storage: Keep materials under cover and dry. Protect against exposure to weather and contact with damp or wet surfaces. Stack lumber as well as plywood and other panels. Provide for air circulation within and around stacks and under temporary coverings including polyethylene and similar materials.

B. Do not deliver interior finish carpentry until environmental conditions meet requirements specified for installation areas. If finish carpentry must be stored in other than installation areas, store only in areas where environmental conditions meet requirements specified for installation areas.

1.6 PROJECT CONDITIONS

A. Environmental Conditions: Obtain and comply with finish carpentry manufacturer's and installer's coordinated advice for optimum temperature and humidity conditions for finish carpentry during its storage and installation.

B. Weather Conditions: Proceed with finish carpentry only when existing and forecasted weather conditions will permit exterior finish carpentry to be installed in compliance with manufacturer's recommendations and when substrate is completely dry.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Lumber Standards: Comply with PS 20 "American Softwood Lumber Standard" for lumber and with applicable grading rules of inspection agencies certified by American Lumber Standards Committee Board of Review.

B. Plywood Standards: Comply with PS 1 "U.S. Product Standard for Construction and Industrial Plywood" for plywood and, for products not manufactured under PS 1, with APA PRP-108.

C. Inspection Agencies: Inspection agencies and the abbreviations used to reference them with lumber grades and species include the following:

1. SPIB - Southern Pine Inspection Bureau.

D. Grade Stamps: Provide lumber with each piece factory-marked with grade stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at time of surfacing, and mill.

1. For exposed lumber furnish pieces with grade stamps applied to ends or back of each piece, or omit grade stamps entirely and provide certificates of grade compliance issued by inspection agency.

E. Formaldehyde Emission Levels: Comply with formaldehyde emission requirements of each voluntary standard referenced below:

1. Particleboard: NPA 8.

2. Medium-Density Fiberboard: NPA 9.
3. Hardwood Plywood: HPMA FE.

2.2 INTERIOR AND EXTERIOR STANDING AND RUNNING TRIM AND RAILS

A. Trim and Rails: For trim in form of boards and worked products, provide lumber complying with the following requirements.

Species: Douglas Fir

2. Texture: Surfaced (smooth).
3. Lumber for Transparent Finish (Stained or Clear): Solid lumber stock.
4. Lumber for Painted Finish: Glued-up lumber or solid lumber stock.

B. Wood Molding Patterns: For stock molding patterns included in Wood Moulding and Millwork Producers Association WM 7 and graded under WM 4, provide the following grade based on finish indicated and fabricated from species specified:

1. Moldings for Transparent Finish: N-Grade.
2. Moldings for Painted Finish: P-Grade.
3. Craftsman Style, S4S with eased edges, sized as indicated on drawings.

C. Kiln Dried 1x6 White Pine Tongue and Groove Shiplap Siding, Nickel Gap.
Stack Height: 5 1/8"
• Thickness: 3/4"
• Gap Size: 1/8" gap on the Tongue side only.
• Available Lengths: 8', 10', 12', 14', and 16'.
• Grade: Finish Grade.
• Joinery Type: Tongue and Groove.
• Installation Type: Stainless Steel Nail or Screw.
• Cutting Waste: Recommended approximately 5%-10% for walls, 15%-25% for gable ends depending on roof angle.
• Typical Weight per linear foot: 3/4 lbs./lf
• Profile: Milled Smooth both sides.

2.3 MISCELLANEOUS MATERIALS

A. Fasteners for Exterior Finish Carpentry: Stainless steel, noncorrosive aluminum or hot-dip galvanized nails, in sufficient length to penetrate minimum of 1-1/2 inches into substrate unless recommended otherwise by manufacturer.

1. Provide prefinished nails for face nailing of material to receive stain in color to match where face nailing is unavoidable.
2. Countersink nails and fill surface where face nailing is unavoidable.

B. Fasteners for Interior Finish Carpentry: Nails, screws, and other anchoring devices of type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible.

1. Countersink nails, fill surface flush, and sand where face nailing is unavoidable.
2. Where finish carpentry materials are exposed in areas of high humidity, provide fasteners and anchorages with hot-dip galvanized coating complying with ASTM A 153.

C. Felt Underlayment: Asphalt-saturated organic felts, unperforated, conforming to requirements of ASTM D 26, Type 1, No. 15.

D. Adhesives: Comply with manufacturer's recommendations for adhesives.

E. Flashing: Comply with requirements of Division 7 Section "Flashing and Sheet Metal" for flashing materials installed in finish carpentry.

1. Horizontal Joint Flashing for Siding: Preformed galvanized steel or aluminum Z-shaped flashing.

F. Sealants: Comply with requirements of Division 7 Section "Joint Sealants" for materials required for sealing siding work.

2.4 PRESERVATIVE TREATMENT BY NONPRESSURE METHOD

A. Treatment Standard: Comply with NWWDA I.S.4 for exterior finish carpentry to receive water-repellent preservative treatment.

1. Water-Repellent Preservative: NWWDA tested and accepted preservative and water-repellent formulation containing 3-iodo-2-propynyl butyl carbamate (IPBC) as its active ingredient.
2. Water-Repellent Preservative/Insecticide: NWWDA tested and accepted preservative and water-repellent formulation containing 3-iodo-2-propynyl butyl carbamate (IPBC) as its active ingredient, combined with an insecticide containing chlorpyrifos as its active ingredient.
3. Extent of Treatment: Treat each item of exterior finish carpentry regardless of species from which it is fabricated.
4. Extent of Treatment: As indicated.

2.5 FIRE-RETARDANT TREATMENT BY PRESSURE PROCESS

A. General: Where fire-retardant-treated wood is indicated, pressure impregnate with fire-retardant chemicals to comply with AWPA C20 for lumber and AWPA C27 for plywood. Identify "fire-retardant-treated wood" with appropriate classification marking of Underwriters Laboratories, Inc.; U.S. Testing; Timber Products Inspection, Inc.; or other testing and inspecting agency acceptable to authorities having jurisdiction.

1. Current Evaluation and Research Reports: Provide fire-retardant wood for which a current model code evaluation and research report exists that is acceptable to authorities having jurisdiction and that evidences compliance of fire-retardant-treated wood for application indicated.

B. Interior Type A: For interior locations use fire-retardant chemical formulation that produces treated lumber and plywood with the following properties under conditions after installation:

1. No reduction takes place in bending strength, stiffness, and fastener-holding capacities below values published by manufacturer of chemical formulation that are based on tests by a qualified independent testing laboratory of treated wood products identical to those indicated for this Project under elevated temperature and humidity conditions simulating installed conditions.
2. No other form of degradation occurs due to acid hydrolysis or other causes related to manufacture and treatment.

3. No corrosion of metal fasteners results from their contact with treated wood.

C. Exterior Type: Use for exterior locations and where indicated.

D. Inspect each piece of treated lumber or plywood after drying and discard damaged or defective pieces.

E. Available Products: Subject to compliance with requirements, fire-retardant-treated wood products that may be incorporated in the Work include, but are not limited to, the following:

1. Interior Type A Fire-Retardant-Treated Wood:

a. "Dricon," Hickson Corporation.
b. "Pyro-Guard," Hoover Treated Wood Products.
c. "Flame Proof LHC-LTT," Osmose Wood Preserving Co., Inc.

2. Exterior Type Fire-Retardant-Treated Wood:

a. "Exterior Fire-X," Hoover Treated Wood Products.

2.6 FABRICATION

A. Wood Moisture Content: Comply with requirements of specified inspection agencies and manufacturer's recommendations for moisture content of finish carpentry in relation to relative humidity conditions existing during time of fabrication and in installation areas. Provide finish carpentry with moisture content that is compatible with Project requirements.

B. Fabricate finish carpentry to dimensions, profiles and details indicated. Ease edges to radius indicated for the following:

1. Lumber less than 1 inch in nominal thickness: 1/16 inch.
2. Lumber 1 inch or more in nominal thickness: 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting installation and performance of finish carpentry. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

B. Condition finish carpentry to average prevailing humidity conditions in installation areas before installation for a minimum of 24 hours unless longer conditioning recommended by manufacturer.

C. Backprime lumber for painted finish exposed on the exterior. Comply with requirements for surface preparation and application in Section "Painting."

3.3 INSTALLATION, GENERAL

A. Do not use finish carpentry materials that are unsound, warped, bowed, twisted, improperly treated or finished, not adequately seasoned, or too small to fabricate with proper jointing arrangements.

1. Do not use manufactured units with defective surfaces, sizes, or patterns.

B. Install finish carpentry plumb, level, true, and aligned with adjacent materials. Use concealed shims where required for alignment.

1. Scribe and cut finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
2. Install to tolerance of 1/8 inch in 8 feet for plumb and level. Install adjoining finish carpentry with 1/16 inch maximum offset for flush installation and 1/8 inch maximum offset for reveal installation.
3. Coordinate finish carpentry with materials and systems that may be in or adjacent to standing and running trim and rails. Provide cutouts for mechanical and electrical items that penetrate exposed surfaces of trim and rails.

C. Finish in accordance with specified requirements.

D. Refer to Division 9 Sections for final finishing of finish carpentry.

3.4 STANDING AND RUNNING TRIM AND RAILS

A. Install with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Stagger joints in adjacent and related standing and running trim and rails. Cope at returns and miter at corners to produce tight-fitting joints with full-surface contact throughout length of joint. Use scarf joints for end-to-end joints. Plane back of casings to provide uniform thickness across joints if required.

1. Match color and grain pattern across joints.
2. Install trim after drywall joint finishing operations are completed.
3. Drill pilot holes in hardwood prior to nailing or fastening to prevent splitting. Fasten to prevent movement or warping. Countersink nail heads on exposed carpentry work and fill holes.
4. Fit exterior joints to exclude water. Apply flat grain lumber with bark side exposed to weather.

3.5 ADJUSTING

A. Repair damaged or defective finish carpentry where possible to eliminate functional or visual defects. Where not possible to repair, replace finish carpentry. Adjust joinery for uniform appearance.

3.6 CLEANING

A. Clean finish carpentry on exposed and semiexposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.

3.7 PROTECTION

A. Provide final protection and maintain conditions that ensure finish carpentry is without damage or deterioration at time of Final Completion.

END OF SECTION 06 20 00

DIVISION 06 00 00: WOOD, PLASTICS and COMPOSITES
Section 06 41 16: Interior Architectural Woodwork

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Wood Shelving.
2. Base and Wall Cabinets.
3. Countertops

B. Related Sections: The following sections contain requirements that relate to this section:

1. Division 6 Section "Rough Carpentry" for furring, blocking, and other carpentry work that is not exposed to view.
2. Division 9 Section "Painting" for final finishing of installed architectural woodwork.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract.

B. Product data for each type of product and process specified in this section and incorporated into items of architectural woodwork during fabrication, finishing, and installation.

C. Shop drawings showing location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

E. Samples for initial selection purposes of the following in form of manufacturer's color charts consisting of actual units or sections of units showing full range of colors, textures, and patterns available for each type of material indicated.

1. Plastic laminate – Wilsonart Laminate High-Pressure Decorative Laminate (basis of design) or approved equal.

F. Product certificates signed by woodwork manufacturer certifying that products comply with specified requirements.

G. Qualification data for firms and persons specified in "Quality Assurance" article to demonstrate their capabilities and experience. Include list of completed projects with project names, addresses, names of Architects and Owners, and other information specified.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Firm experienced in successfully producing architectural woodwork similar to that indicated for this Project, with sufficient production capacity to produce required units without causing delay in the Work.

B. Single-Source Responsibility: Arrange for production by a single firm of architectural woodwork.

C. Single-Source Manufacturing and Installation Responsibility: Engage a qualified Manufacturer to assume undivided responsibility for woodwork specified in this section, including fabrication, finishing, and installation.

D. Installer Qualifications: Arrange for installation of architectural woodwork by a firm that can demonstrate successful experience in installing architectural woodwork items similar in type and quality to those required for this project.

E. AWI Quality Standard: Comply with applicable requirements of "Architectural Woodwork Quality Standards" published by the Architectural Woodwork Institute (AWI) except as otherwise indicated.

F. Forest Certification: Provide interior architectural woodwork produced from wood obtained from forest certified by an FSC-accredited certification body to comply with FSC 1.2, “Principles and Criteria”.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect woodwork during transit, delivery, storage, and handling to prevent damage, soilage, and deterioration.

B. Do not deliver woodwork until painting, wet work, grinding, and similar operations that could damage, soil, or deteriorate woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas whose environmental conditions meet requirements specified in "Project Conditions."

1.6 PROJECT CONDITIONS

A. Environmental Conditions: Obtain and comply with Woodwork Manufacturer's and Installer's coordinated advice for optimum temperature and humidity conditions for woodwork during its storage and installation. Do not install woodwork until these conditions have been attained and stabilized so that woodwork is within plus or minus 1.0 percent of optimum moisture content from date of installation through remainder of construction period.

B. Field Measurements: Where woodwork is indicated to be fitted to other construction, check actual dimensions of other construction by accurate field measurements before manufacturing woodwork; show recorded measurements on final shop drawings. Coordinate manufacturing schedule with construction progress to avoid delay of Work.

1. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with manufacture of woodwork without field measurements. Coordinate other construction to ensure that actual dimensions correspond to guaranteed dimensions.

PART 2 - PRODUCTS

2.1 HIGH PRESSURE DECORATIVE LAMINATE MANUFACTURERS

A. Available Manufacturer: Subject to compliance with requirements, manufacturer offering high pressure decorative laminate which may be incorporated in the work includes but is not limited to

the following:

1. Wilsonart Laminate High-Pressure Decorative Laminate (basis of design) or approved equal.

2.2 MATERIALS

A. General: Provide materials that comply with requirements of the AWI woodworking standard for each type of woodwork and quality grade indicated and, where the following products are part of woodwork, with requirements of the referenced product standards, that apply to product characteristics indicated:

1. Hardboard: ANSI/AHA A135.4
2. High Pressure Laminate: NEMA LD 3.
3. Medium Density Fiberboard: ANSI A208.2, Grade MD, made with binder containing no urea formaldehyde.
4. Particleboard: ANSI A208.1, Grade M-2 – Ext. glue.
5. Softwood Plywood: PS 1.
6. Particleboard: Straw-based particleboard complying with requirements in ANSI A208.1, Grade M-2, except for density.
7. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1 made with adhesive containing no urea formaldehyde. Provide species of veneer as indicated on drawings and provide hardwood edging on all finish veneer plywood.

2.3 FABRICATION, GENERAL

A. Wood Moisture Content: Comply with requirements of referenced quality standard for moisture content of lumber in relation to relative humidity conditions existing during time of fabrication and in installation areas.

B. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:

1. Corners of cabinets and edges of solid wood (lumber) members less than 1 inch in nominal thickness: 1/16 inch.
2. Edges of rails and similar members more than 1 inch in nominal thickness: 1/8 inch.

C. Complete fabrication, including assembly, finishing, and hardware application, before shipment to project site to maximum extent possible. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

D. Factory-cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Smooth edges of cutouts and, where located in countertops and similar exposures, seal edges of cutouts with a water-resistant coating.

2.4 WOOD MILLWORK (BASE AND WALL) FOR OPAQUE FINISH

A. Quality Standard: Comply with AWI Section 400 and its Division 400A "Wood Cabinets."

B. Grade: Premium.

C. AWI Type of Cabinet Construction: Flush with exposed face frame.

D. Wood Species for Exposed Surfaces: As indicated.

1. Grain Matching: Run and match grain vertically for drawer fronts, doors, and fixed panels.
2. Matching of Veneer Leaves: Book match.
3. Veneer Matching Within Panel Face: Center match.
4. Comply with veneer and other matching requirements indicated for blueprint-matched paneling.

E. Wood Species for Semi-exposed Surfaces: Match species and cut indicated for exposed surfaces.

F. Provide dust panels of 1/4-inch plywood or tempered hardboard above compartments and drawers except where located directly under tops.

2.5 CABINET HARDWARE AND ACCESSORY MATERIALS

A. Hardware Standard: Comply with ANSI/BHMA A156.9 "American National Standard for Cabinet Hardware" for items indicated by reference to BHMA numbers or referenced to this standard.

B. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with ANSI/BHMA A156.18 for BHMA code number indicated.

1. Cabinet Door and drawer pulls shall be standard European solid 4” wire pulls in finish to match door hardware.

C. For concealed hardware including all hinges provide manufacturer's standard finish that complies with product class requirements of ANSI/BHMA A156.9.

D. Waste Containers shall be as follows where indicated on the drawings:

1. Single Bottom Mount Aluminum Waste Containers: Rev-A-Shelf Model # 5349-15DM-1SS

2.6 ARCHITECTURAL CABINET TOPS, SPLASHES, DOOR AND DRAWER FRONTS

A. Quality Standard: Comply with AWI Section 400 and its Division 400C.

B. Type of Top: High pressure decorative laminate complying with the following:

1. Grade: Custom.
2. Laminate Cladding for Horizontal and Vertical Surface: High pressure decorative laminate as follows:

a. Colors, Patterns and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces as selected by the Architect from the full range available for the laminate cladding previously specified. Colors shall be selected by Architect.

b. Grade: GP-50 (0.050-inch nominal thickness/0.048-inch actual).

3. Edge Treatment: Finished Edge as indicated.

C. Solid Surface Counter Tops as shown on drawings:

Quartz	Cambria	3CM	Straight Edged / Polished TBD
Laundry Room	Corian Solid Surface by Dupont ½" thick		

D. Granite Counter Tops where shown on drawings. Robert Henry Tile, Granite, Polished

2.7 FASTENERS AND ANCHORS

A. Screws: Select material, type, size, and finish required for each use. Comply with FS FF-S-111 for applicable requirements.

1. For metal framing supports, provide screws as recommended by metal framing manufacturer.

B. Nails: Select material, type, size, and finish required for each use. Comply with FS FF-N-105 for applicable requirements.

C. Anchors: Select material, type, size, and finish required by each substrate for secure anchorage. Provide nonferrous metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts and anchors, as required, to be set into concrete or masonry work for subsequent woodwork anchorage.

2.8 MISCELLANEOUS MATERIALS

A. Adhesives shall not contain urea formaldehyde.

B. VOC Content for Installation Adhesives and Glues: Comply with the following limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Wood Glues: Not more than 30 g/L.
2. Contact Adhesive: Not more than 250 g/L.

PART 3 - EXECUTION

3.1 PREPARATION

A. Condition woodwork to average prevailing humidity conditions in installation areas before installing.

B. Deliver concrete inserts and similar anchoring devices to be built into substrates well in advance of time substrates are to be built.

C. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including back priming and removal of packing.

3.2 INSTALLATION

A. Quality Standard: Install woodwork to comply with AWI Section 1700 for same grade specified in Part 2 of this section for type of woodwork involved.

B. Install woodwork plumb, level, true, and straight with no distortions. Shim as required with concealed shims. Install to a tolerance of 1/8 inch in 8'-0" for plumb and level (including tops) and with no variations in flushness of adjoining surfaces.

C. Scribe and cut woodwork to fit adjoining work and refinish cut surfaces or repair damaged finish at cuts.

D. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation. Except where prefinished matching fastener heads are required, use fine finishing nails for exposed nailing, countersunk and filled flush with woodwork and matching final finish where transparent finish is indicated.

E. Cabinets: Install without distortion so that doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete the installation of hardware and accessory items as indicated. Maintain veneer sequence matching (if any) of cabinets with transparent finish.

F. Tops: Anchor securely to base units and other support systems as indicated.

G. Complete the finishing work specified in this section to whatever extent not completed at shop or before installation of woodwork.

H. Refer to the Division 9 sections for final finishing of installed architectural woodwork.

3.3 ADJUSTMENT AND CLEANING

A. Repair damaged and defective woodwork where possible to eliminate defects functionally and visually; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean woodwork on exposed and semi exposed surfaces. Touch up factory-applied finishes restoring damaged or soiled areas.

3.4 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer, which ensures that woodwork is being without damage or deterioration at time of Final Acceptance.

END OF SECTION 06 41 16

SECTION 07 21 19: FOAMED-IN-PLACE INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Foamed-in-Place Insulation of the following types:
   1. Closed-cell, spray-applied, polyurethane foam insulation.
   2. Open-cell, spray applied, polyurethane foam insulation.

B. Accessories.

1.2 RELATED SECTIONS

A. Section 07 21 19 - Foamed-In-Place Insulation.

1.3 REFERENCES

A. ASTM International (ASTM):
   1. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
   2. ASTM D1621 - Standard Test Method for Compressive Properties of Rigid Cellular Plastics.
   3. ASTM D1622 - Standard Test Method for Apparent Density of Rigid Cellular Plastics.
   4. ASTM D1623 - Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics.
   5. ASTM D2126 - Standard Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging.
   6. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics.
   7. ASTM D2856 - Standard Test Method for Open-Cell Content of Rigid Cellular Plastics by the Air Pycnometer.
   8. ASTM D6226 - Standard Test Method for Open Cell Content of Rigid Cellular Plastics.
   9. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
   10. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
   11. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
   12. ASTM E413 - Classification for Rating Sound Insulation.
   13. ASTM E423 - Standard Test Method for Normal Spectral Emittance at Elevated Temperatures of Nonconducting Specimens.
   14. ASTM E2178 - Standard Test Method for Air Permeance of Building Materials.
   15. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

B. ICC Evaluation Service (ICC-ES):
   1. ICC-ES AC377 - Acceptance Criteria for Spray-Applied Foam Plastic Insulation.

C. International Association of Plumbing and Mechanical Officials (IAPMO).

D. Spray Polyurethane Foam Alliance: Professional Certification Program (SPFA PCP).

1.4 SUBMITTALS

A. Submit under provisions of Section 01 33 00 - Administrative Requirements.

B. Product Data: Submit manufacturer's product data, including surface preparation and application instructions.

C. Manufacturer's Certification:
   1. Submit manufacturer's certification that materials comply with specified requirements and are suitable for intended application.
   2. Submit manufacturer's certification from SPFA PCP as Accredited Supplier Company.
   3. Submit evidence that manufacturer has Dunn & Bradstreet rating of 5A or can supply performance bond.

D. Product Evaluation Reports: Submit manufacturer's product evaluation reports from accredited evaluation service.

E. Manufacturer's Project References: Submit manufacturer's list of 5 successfully completed polyurethane foam insulation projects of similar size and scope, including project name and location, name of architect, and type and quantity of materials furnished.

F. Applicator's Project References: Submit applicator's list of successfully completed polyurethane foam insulation projects, including project name and location, name of architect, and type and quantity of materials applied.

G. Warranty Documentation: Submit manufacturer's standard warranty.

1.5 QUALITY ASSURANCE

A. Manufacturer's Qualifications:
   1. Manufacturer regularly engaged, for a minimum of 10 years, in the manufacturing of polyurethane foam insulation of similar type to that specified.
   2. Accreditation: SPFA PCP as Accredited Supplier Company.

B. Applicator's Qualifications:
   1. Applicator regularly engaged, for a minimum of 5 years, in application of polyurethane foam insulation of similar type to that specified.
   2. Certified by manufacturer to install their products.
   3. Use persons trained by manufacturer in polyurethane foam insulation application or certified by SPFA PCP as Master Installer - Insulation, Closed Cell.

C. Source Limitations: Provide each type of product from a single manufacturing source to ensure uniformity.

D. Mock-Up: Construct a mock-up with actual materials in sufficient time for Architect's review and to not delay construction progress. Locate mock-up as acceptable to Architect and provide temporary foundations and support.
   1. Intent of mock-up is to demonstrate quality of workmanship and visual appearance.
   2. If mock-up is not acceptable, rebuild mock-up until satisfactory results are achieved.
   3. Retain mock-up during construction as a standard for comparison with completed work.
   4. Do not alter or remove mock-up until work is completed or removal is authorized.

1.6 PRE-INSTALLATION CONFERENCE

A. Convene a conference approximately two weeks before scheduled commencement of the Work.

B. Require attendance of parties directly affecting Work of this Section, including Contractor, Architect, applicator, and manufacturer's representative.

C. Review the Following:

1. Materials.
2. Protection of in-place conditions.
3. Surface preparation.
4. Application.
5. Field quality control.
6. Cleaning.
7. Protection.
8. Coordination with other Work.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Delivery Requirements: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Storage and Handling Requirements:
1. Store and handle materials in accordance with manufacturer's instructions.
2. Keep materials in manufacturer's original, unopened containers and packaging until application.
3. Store materials in clean, dry area indoors.
4. Store materials at 70 to 80 degrees F (21 to 27 degrees C) a minimum of 48 hours before use.
5. Store materials out of direct sunlight.
6. Protect materials from freezing.
7. Protect materials during storage, handling, and application to prevent contamination or damage.

1.8 PROJECT CONDITIONS

A. Ambient and Substrate Temperatures: As recommended by Manufacturer.

B. Moisture: Do not apply polyurethane foam insulation when moisture in form of rain, snow, ice, fog, frost, or dew is expected during application.

C. Relative Humidity: Do not apply polyurethane foam insulation when relative humidity over 85 percent is expected during application.

D. Wind: Do not apply polyurethane foam insulation with wind speed above 12 mph (19 kmh).

E. Do not apply polyurethane foam insulation under ambient conditions outside manufacturer's limits.

1.9 WARRANTY

A. Manufacturer's Warranty: Provide manufacturer's standard limited warranty.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Carlisle Spray Foam Insulation (SFI), Basis of Design or prior approved equivalent.

B. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

2.2 CLOSED-CELL, SPRAY-APPLIED, POLYURETHANE FOAM INSULATION

A. Basis of Design: SealTite Pro Closed Cell; as manufactured by Carlisle Spray Foam

Insulation.

1. Performance and Design Requirements:
   a. Standards Compliance:
      1) Acceptance Criteria: ICC-ES AC377, Appendix X, for use without prescribed ignition barrier and without need for additional fire-resistant coating.
      2) Evaluation Report: IAPMO UES-621.
      3) Greenguard Gold.
   b. Air Leakage Rate,ASTM E2178: Less than 0.004 cfm per sq ft (0.02 L per sec per sq m).
   c. Moisture Vapor Transmission, Permeance,ASTM E96:
      1) Thickness, 1 inch (25 mm): 0.80 perm.
      2) Thickness, 3.5 inches (89 mm): 0.23 perm.
      3) Thickness, 5.5 inches (140 mm): 0.14 perm.
      4) Thickness, 7.9 inches (201 mm): 0.10 perm.
   d. Core Density,ASTM D1622: 2.0 pcf (32 kg per cu m), nominal.
   e. R-Value, Aged,ASTM C518:
      1) Thickness, 1 inch (25 mm): 6.9.
      2) Thickness, 3 inches (76 mm): 21.
   f. Compressive Strength,ASTM D1621: 25 psi (172 kPa), nominal.
   g. Tensile Strength,ASTM D1623: 60 psi (414 kPa), nominal.
   h. Water Absorption,ASTM D2842: Less than 2 percent.
   i. Dimensional Stability,ASTM D2126, Change in Volume:
      1) 158 Degrees F (70 degrees C), 97 Percent Relative Humidity: Less than 9 percent.
   j. Closed Cell Content,ASTM D2856: Greater than 90 percent.
   k. Surface Burning Characteristics, ASTM E84, 4 Inches (102 mm):
      1) Flame Spread Index: Less than 25.
      2) Smoke Developed Index: Less than 450.
   l. Fungi Resistance,ASTM G21: Zero rating.
2. Description: Two-component, HFC-245fa blown, medium-density system.
   a. A-Component: Aromatic diisocyanate.
   b. B-Component: Polyols, fire-retarding materials, and additives.
3. Grade: Summer.

2.25 OPEN-CELL, SPRAY APPIED POLYURETHANE INSULATION

A. Basis of Design :**SealTite PRO Open Cell.** SealTite PRO Open Cell is a two component, light density, one to one by volume spray-applied polyurethane foam insulation. SealTite PRO Open Cell contains ZERO ozone depleting blowing agents and can be used in Assembly specific attic or crawlspace applications without an Ignition Barrier.

Physical Property	Test Method ASTM	SealTite™ Pro Open Cell	SealTite™ Pro High Yield	SealTite™ Pro No Mix	SealTite™ Pro No Trim 21	SealTite™ Pro OCX
R-Value, @ 1"	C 518	3.7	3.6	3.8	4.4	3.7
R-Value, @ 3.5"	C 518	13	13	13	15	12
Core Density, lb/cf	D 1622	0.50	0.45	0.5	0.75	0.5
Open-cell content, %, min.	D 2856	90	97	97	97	95
Air Impermeable, max, (L/s-m2) @ 3.5"	E 283	0.02	0.02	0.02	0.02	0.02
Tensile Strength, psi, min.	D 1623	3	5	5.19	4.7	3.71
Dimensional Stability, 28 days, percent volume change, max.	D 2126	15	15	5	4	15
Flame Spread, max.	E-84	25	10	20	20	0
Smoke Development, max.	E-84	450	250	400	400	300

2.3 ACCESSORIES

A. Primer: as recommended by Manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas to receive polyurethane foam insulation.

B. Notify Architect of conditions that would adversely affect application.

C. Do not begin surface preparation or application until unacceptable conditions are corrected.

3.2 PREPARATION

A. Protection of In-Place Conditions:
   1. Protect adjacent surfaces from contact with overspray.
   2. Protect electrical outlet and junction boxes from contact with polyurethane foam insulation.

B. Surface Preparation:
   1. Prepare surfaces in accordance with manufacturer's instructions.
   2. Remove dirt, dust, debris, oil, grease, rust, loose scale, ice, frost, moisture, and other surface contaminants which could adversely affect application of polyurethane foam insulation.

3.3 INSTALLATION

A. Spray-apply polyurethane foam insulation in accordance with manufacturer's instructions at locations indicated on the Drawings.

B. Material Temperature: Maintain materials in containers at 65 to 85 degrees F (18 to 29 degrees C) while in use.

C. Ensure substrates are dry during application.

D. Insulation Thickness:
   1. Maximum Pass Thickness: 4 inches (102 mm).
   2. Total Thickness: Indicated on the Drawings.

E. Apply polyurethane foam insulation to uniform thickness without voids, pinholes, cracks, and crevices.

3.4 FIELD QUALITY CONTROL

A. Field Inspection: Coordinate field inspection in accordance with appropriate sections in Division 01.

B. Inspect completed application of polyurethane foam insulation, including:
   1. Total thickness.
   2. Free of voids, pinholes, cracks, and crevices.
   3. Adhesion to substrate.

3.5 CLEANING AND PROTECTION

A. Promptly clean surfaces that receive overspray of polyurethane foam insulation.

B. Do not use harsh cleaning materials or methods that could damage surfaces.

C. Protect Work of this Section from damage during construction.

END OF SECTION

SECTION 07 25 00 –

WEATHER BARRIERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Commercial weather barrier assemblies.
2. Flexible flashing.
3. Weather barrier flashing.

B. Related Requirements:
1. Section 074646 "Fiber-Cement Siding" for installation of fiber-cement board siding.

1.3 DEFINITIONS

A. Weather Barrier: A combination of materials and accessories that do the following:

1. Prevent the accumulation of water as a water-resistive barrier.
2. Minimize the air leakage into or out of the building envelope as a continuous air barrier.
3. Provide sufficient water vapor transmission to enable drying as a vapor-permeable membrane.

B. Water-Resistive Barrier: A combination of materials and accessories that prevent the accumulation of water within the wall assembly per International Building Code Section 1403.2.

C. Continuous Air Barrier: The combination of interconnected materials, assemblies, and sealed joints and components of the building envelope that minimize air leakage into or out of the building envelope per ASHRAE 90.1 section 5.4.3.1.

D. Vapor Diffusion: A slow movement of individual water vapor molecules from regions of higher to lower water vapor concentration (higher to lower vapor pressure).

E. Vapor Permeable Membrane: The property of having a water-vapor permeance rating of 10 perms (575 ng/Pa x s x sq. m) or greater, when tested in accordance with the desiccant method using Procedure A of ASTM E96 per definition in International Building Code. Vapor permeable material permits the passage of moisture vapor through vapor diffusion.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at project site.

1. Meet with Owner, Architect, Manufacturer's Certified Installer, and installers of work that interfaces with or affects weather barrier.
2. Review methods and procedures related to weather barrier installation, including manufacturer's written instructions.
3. Review and finalize construction, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine substrate conditions and finishes for compliance with requirements.
5. Review flashings, special weather barrier details, weather barrier penetrations, and condition of other construction that affects weather barrier.
6. Review weather barrier manufacturer's Project Registration and Observation process.
7. Review Construction Indoor Air Quality Management Plan "Moisture Protection for Absorbent Materials."
8. Review temporary protection requirements for weather barrier during and after installation.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For weather barrier, include data on air and water-vapor permeance based on testing in accordance with referenced standards.

B. Shop Drawings: Show details of weather barrier at terminations, openings, and penetrations. Show details of flexible flashing applications.

1.6 INFORMATIONAL SUBMITTALS

A. Manufacturer's Instructions: For installation of each product specified.

B. Sample Warranty: For manufacturer's warranty.

C. Reports: Field test and inspection reports.

D. Installer's weather barrier manufacturer-training certificate.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified firm that is certified by weather barrier system manufacturer to install manufacturer's product.

B. Mockups: Build mockups to set quality standards for materials and execution.

1. Build integrated mockups of exterior wall assembly **150 sq. ft.**, incorporating backup wall construction, external cladding, window, storefront, door frame and sill, insulation, ties and other penetrations, and flashing to demonstrate surface preparation, crack and

joint treatment, application of weather barriers, and sealing of gaps, terminations, and penetrations of air-barrier assembly.

a. Include junction with building corner condition, and foundation wall intersection fenestration and wall interface.
b. If Architect determines mockups do not comply with requirements, reconstruct mockups and apply weather barrier until mockups are approved.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

C. Manufacturer's Field Service: Register Project with weather barrier manufacturer prior to installation of weather barrier and comply with weather barrier manufacturer's Project registration and observation process.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Do not store near heat source or open flame.

1.9 WARRANTY

A. Manufacturer's Product Warranty: To repair or replace weather barrier product that fails in materials within specified warranty period.

1. Warranty Period: 10 years from date of purchase.

B. Manufacturer's Product and Labor Warranty: Manufacturer agrees to repair or replace weather barrier that fails in materials within specified warranty period, including removal and replacement of affected construction up to manufacturer's limits.

1. Warranty Period: **10 years from date of purchase**.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain weather barrier assembly components, including weather barrier and weather barrier flashing from [same manufacturer as weather barrier.

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Installed weather barrier and accessories shall withstand specified wind pressures, liquid water penetration, and water vapor pressures without failure due to defective manufacture of products.

B. High-Performance Installations:

1. For installation with one of the following building envelope performance or structural characteristics:

   a. Exceeding 65 mph (100 km/h) equivalent structural load.
   b. Exceeding 50 mph/6.24 psf (80 km/h)equivalent wind-driven rainwater infiltration.
   c. Wood based primary structure with performance criteria.

2.3 WEATHER BARRIER

A. Commercial Building Wrap: ASTM E2357 passed, ABAA (Air Barrier Association of America) evaluated air barrier assembly, and assembly water resistance per ASTM E331; with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested in accordance with ASTM E84; UV stabilized for nine-month exposure; and acceptable to authorities having jurisdiction.

1. Basis-of-Design Product: Subject to compliance with requirements, provide DuPont de Nemours, Inc.; **Tyvek CommercialWrap** Basis of Desing or prior approved equivalent product.

2. System Description, Single-Layer Weather Barrier: Single-layer weather barrier, including flashing and sealing of penetrations and seams.
3. Air Permeance, Product: Not more than **0.004 cfm/sq. ft. at 1.57 lbf/sq. ft. (0.02 L/s x sq. m at 75 Pa)**] when tested in accordance with ASTM E2178.
4. Air Permeance, Assembly: Not more than 0.04 cfm/sq. ft. at 1.57 lbf/sq. ft. (0.2 L/s x sq. m at 75 PA) when tested in accordance with ASTM E 2357 and evaluated by ABAA.
5. Water Penetration Resistance, Product: Hydrostatic head resistance greater than 22 inches (55 cm) in accordance with AATCC 127.
6. Water Penetration Resistance, Assembly: Assembly wall specimen described in ASTM E2357 to water resistance in accordance with ASTM E331 to **6.24 lbf/sq. ft. (300 Pa)**] Select one of two "Water-Vapor Permeance" subparagraphs below based on product used in single-layer system or as the primary layer used in double-layer system.
10. Water-Vapor Permeance: Not less than 23 perms (1300 ng/Pa x s x sq. m) per ASTM E96/E96M, Desiccant Method (Procedure A) or not less than 28 perms (1600 ng/Pa x s x sq. m) per ASTM E96/E96M, Water Method (Procedure B).

11. Allowable UV Exposure Time: Not less than 9 months (270 days) when tested in accordance with ASTM G155 (Accelerated Weathering).
12. Flame Propagation Test: Materials and construction shall be as tested in accordance with NFPA 285.
13. Heat and Visible Smoke Release Rates: Maximum rates in accordance with NFPA 285.

    a. Peak Heat Release: 13,217 Btu/sq. ft. (150 kW/sq. m).
    b. Total Heat Release: 1762 Btu/sq. ft. (20 MJ/sq. m)
    c. Effective Heat of Combustion: 7744 Btu/lb (18 MJ/kg)

14. Weather barrier system to have a VOC content of 30 g/L or less.

2.4 WEATHER BARRIER FLASHING

A. Conformable Weather Barrier Flashing: Composite flashing material composed of micro-creped, polyethylene laminate with a 100 percent butyl-based adhesive layer; AAMA 711 Class A (no primer), Level 3 thermal exposure, 176 deg F (80 deg C) for seven days.

1. Basis-of-Design Product: Subject to compliance with requirements, provide DuPont de Nemours, Inc.; **DuPont™ FlexWrap™** Basis of Design or prior approved equivalent:

2. Conformability: Able to create a seamless sill pan extending up the jambs without cuts, patches, or fasteners.
3. Water Penetration: No leakage at 15 psf (720 Pa) per ASTM E331.
4. Low Temperature Adhesion: Exceeds minimum value of 1.5 lb./in. (0.26N/mm) at 25 deg F (minus 4 deg C) as Class A (without primer use).
5. Adhesion After Water Immersion: Exceeds minimum value of 1.5 lb./in. (0.26N/mm), after AAMA 800, Sections 2.4.1.3.1/2.4.1.4.3, Test B.

B. Conformable Weather Barrier Flashing for Sealing Penetrations: Composite flashing material composed of micro-creped, polyethylene laminate with a 100 percent butyl-based adhesive layer; AAMA 711 Class A (no primer), Level 3 thermal exposure, 176 deg F (80 deg C) for 7 days.

1. Basis-of-Design Product: Subject to compliance with requirements, provide DuPont Safety & Construction: DuPont de Nemours, Inc.; **DuPont™ FlexWrap™ EZ** Basis of Design or prior approved equivalent.
2. Conformability: Able to create a continuous watertight seal around penetrations from weather barrier to penetration without cuts, patches, or fasteners.
3. Water Penetration: No leakage at 15 psf (720 Pa) per ASTM E 331.
4. Low Temperature Adhesion: Exceeds minimum value of 1.5 lb./in. (0.26N/mm) at 25 degrees F (minus 4 deg C) as Class A (without primer use).
5. Adhesion After Water Immersion: Exceeds minimum value of 1.5 lb./in. (0.26N/mm), after AAMA 800, Sections 2.4.1.3.1/2.4.1.4.3, Test B.

C. Strip Flashing: Composite flashing material composed of spunbonded polyethylene laminate with 100 percent butyl-based, dual-sided, adhesive layer; AAMA 711, Class A (no primer), Level 3 thermal exposure, 176 deg F (80 deg C) for seven days.

1. Basis-of-Design Product: Subject to compliance with requirements, provide DuPont de Nemours, Inc.; [**DuPont™ StraightFlash™**] Basis of Design or prior approved equivalent.

2. ASTM E331 applies to water penetration testing of exterior windows, skylights, doors, and curtain walls.

3. Water Penetration: No leakage at 15 psf (720 Pa) per ASTM E331.
4. Low Temperature Adhesion: Exceeds minimum value of 1.5 lb./in. (0.26N/mm) at 25 deg F (minus 4 deg C) as Class A without primer use.

5. Adhesion After Water Immersion: Exceeds minimum value of 1.5 lb./in. (0.26N/mm), after AAMA 800, Sections 2.4.1.3.1/2.4.1.4.3, Test B.

2.5 WEATHER BARRIER ACCESSORIES

A. Building Wrap Tape: Pressure-sensitive plastic tape recommended by weather barrier manufacturer for sealing joints and penetrations in commercial building wrap.

1. Basis-of-Design Product: Subject to compliance with requirements, provide DuPont de Nemours, Inc.; Tyvek® Tape or comparable product.

B. Closed-Cell Polyurethane Foam Insulation: Low-pressure, low-expansion, single-component polyurethane foam, with maximum flame-spread and smoke-developed indexes of 15 and 25, respectively, per ASTM E84.

1. Basis-of-Design Product: Subject to compliance with requirements, provide DuPont de Nemours, Inc.; DuPont™ Great Stuff Pro or comparable product.

C. Fasteners with Self-Gasketing Washers: Commercial building wrap manufacturer's recommended pneumatically or hand-applied fasteners with **1-inch- (25-mm** diameter, high-density polyethylene cap washers with UV inhibitors.

1. Basis-of-Design Product: Subject to compliance with requirements, provide DuPont de Nemours, Inc.; Tyvek® Wrap Caps or comparable product.

D. Primer for Flashings: Synthetic rubber-based product; spray applied. Strengthen adhesive bond at low temperature applications between weather products such as self-adhered flashing products, commercial building wraps, and common building sheathing materials.

1. Peel Adhesion Test: Passes in accordance with ASTM D3330, Test Method F, for the following.

a. Peel Angles: 0, 25, 72, and 180 degrees.
b. Substrates: Concrete masonry units (CMUs), exterior gypsum sheathing, oriented strand board (OSB), aluminum, and vinyl.

2. Chemical Compatibility: Pass; AAMA 713.
3. Flame Spread Index: 5; ASTM E84.
4. Smoke Development Index: 0; ASTM E84.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements.

B. Verify that substrate and surface conditions are in accordance with commercial weather barrier manufacturer recommendations prior to installation.

1. Verify that rough sill framing for doors and windows is sloped downwards towards the exterior and is level across width of the opening.

C. Verify that surfaces to receive weather barrier flashing are clean, dry, and free of frost.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Direct water onto an acceptable weather barrier drainage plane with an unobstructed path to exterior of wall.

1. Provide a drainage path for water intrusion through window and door attachment system that collects at window and door sills and directs water to the exterior or weather barrier.

3.3 COMMERCIAL BUILDING WRAP INSTALLATION

A. General: Comply with weather barrier manufacturer's written installation guidelines and warranty requirements.

B. Cover exposed exterior surface of sheathing with weather barrier securely fastened to framing immediately after sheathing is installed.

1. Maintain continuity of air and water barrier assemblies.
2. Start weather barrier installation at a building corner, leaving 12 inches (300 mm) of weather barrier extended beyond corner to overlap.
3. Install weather barrier horizontally starting at lower portion of wall surface.
4. Provide minimum 6 inches (150 mm) overlap at horizontal- and vertical-wrap seams in a shingle manner to maintain continuous downward drainage plane and air and water barrier.

C. Seams: Seal seams with building wrap tape per manufacturer's recommended installation instructions.

1. Shiplap horizontal seams in weather barrier to facilitate proper drainage.

D. Fasteners: Use weather barrier manufacturer's recommended fasteners to secure weather barrier and install fasteners according to weather barrier manufacturer's installation guidelines.

1. Do not use temporary fasteners to permanently attach weather barrier.
2. Do not place fasteners with gasketing washers where weather barrier flashing will be installed.
3. Install fasteners with gasketing washers through flashing where recommended by manufacturer.

E. Openings: Completely cover openings with weather barrier, then cut weather barrier membrane to openings in accordance with weather barrier manufacturer's installation guidelines.

1. Provide head and jamb flaps and seam overlaps to maintain continuous drainage.
2. Repair damage to weather barrier using method recommended by weather barrier manufacturer.
3. Install flashing in accordance with weather barrier manufacturer's installation guidelines.

3.4 WEATHER BARRIER FLASHING INSTALLATION

A. Installation: Remove wrinkles and bubbles, reposition weather barrier as necessary to produce a uniform, smooth surface.

1. Ensure that ambient and substrate surface temperatures are acceptable in accordance with manufacturer instructions and recommendations.
2. Wipe surfaces to remove moisture, dirt, grease and other debris that could interfere with adhesion.
3. Apply weather barrier manufacturer's recommended primer over concrete, masonry, and glass-mat gypsum wall sheathing substrates to receive weather barrier flashing.
4. Lap weather barrier flashing a minimum of 2 inches (50 mm) onto weather barrier.
5. Apply pressure over entire surface using roller or firm hand pressure

B. Rough Openings: Shiplap flashing with weather barrier in a shingle manner to maintain a continuous downward drainage plane and air and water barrier in accordance with manufacturer's written instructions.

1. Apply **9-inch- (230-mm-)** wide conformable weather barrier flashing at door and window sills.
2. Ensure that sill flashing does not slope to the interior.
3. Install backer rod in joint between frame of opening product and flashed rough opening on the interior.
4. Apply sealant or closed-cell polyurethane foam insulation around entire opening/fenestration product to create air seal around interior perimeter of window openings in accordance with weather barrier manufacturer's instructions.
5. Around door and window openings, apply butyl-based flashing to flaps of weather barrier.
6. Use strip flashing with wrap cap screws to secure head flap of the windows.

C. Penetrations: Apply weather barrier manufacturer's recommended weather barrier flashing patches behind fastening plates, such as brick-tie base plates, metal-flashing clips, and metal channels.

1. Seal weather barrier around each penetration with weather barrier manufacturer's recommended self-adhered flashing product or sealant. Integrate products with flanges into the weather barrier.

D. Terminations: Provide minimum 2 inches (50 mm) overlap using strip flashing on adjoining roof and base of wall systems to maintain continuous downward drainage plane.

1. Secure weather barrier with fasteners and weather barrier flashing.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to train installers and observe subject test-wall areas and installations.

3.6 CLEANING

A. Immediately remove release paper and scrap from work area and dispose of material.

3.7 PROTECTION

A. Protect installed weather barrier from the following:

1. Damage from cladding, structure, or a component of the structure (for example, window, door, or wall system).
2. Contamination from building site chemicals, premature deterioration of building materials, or nonstandard use or application of products.
3. Foreign objects or agents, including the use of materials incompatible with weather barrier products.
4. UV exposure in excess of products' stated limits.

END OF SECTION 072500

SECTION 073010 PEEL AND STICK UNDERLAYMENT

PART 1 — GENERAL

1.1 SUMMARY

A. This Section specifies a self-adhering sheet membrane used as underlayment for sloped roofs.
   1. Severe climate application, Grace Ice & Water Shield®.

B. Related Sections: Refer to the following specification sections for coordination:
   1. Section 061000 - Rough Carpentry.
   2. Section 073110 – Dimensional Asphalt Shingles.
   3. Section 074110 – Standing seam Roofing
   4. Section 047000 – Manufactured Stone

C. Referenced Standards: Comply with the requirements of the following standards published by ASTM International to the extent referenced in this section.
   1. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension.
   2. ASTM D461 - Standard Test Methods for Felt.
   3. ASTM D 903 - Standard Test Method for Peel or Stripping Strength of Adhesive Bonds.
   4. ASTM D1970 - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.
   5. ASTM D3767 - Standard Practice for Rubber—Measurement of Dimensions.
   6. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
   7. ASTM G90 – EMMAqua test.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions.

1.3 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with requirements of authorities having jurisdiction and applicable codes at the location of the project.

B. Manufacturer: Minimum 10 years’ experience producing roofing underlayment.

C. Installer: Minimum 2 years’ experience with installation of similar underlayment.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver materials and products in unopened factory labeled packages. Protect from damage.

B. Cover materials and store in dry condition between temperatures of 40 and 90 degrees F (5 and 32 degrees C). Use within one year of date of manufacture. Do not store at elevated temperatures as that will reduce the shelf life of the product.

PART 2 — PRODUCTS

2.1 MANUFACTURER

A. Manufacturer: GCP Applied Technologies, Inc, 62 Whittemore Avenue, Cambridge, MA 02140, Toll Free 866-333-3726, www.gcpat.com. Basis of Design or prior approved equivalent.

2.2 MATERIALS

A. Self-Adhering Sheet Membrane Roof Underlayment: Provide Grace Ice and Water Shield by GCP Applied Technologies, Inc., Basis of Design or prior approved equivalent, with the following characteristics:
   1. Material: Cold applied, self-adhering membrane composed of a high strength polyethylene film coated on one side with a layer of rubberized asphalt adhesive and

interwound with a disposable release sheet. An embossed, slip resistant surface is provided on the polyethylene.

2. Color: Gray-black.
3. Membrane Thickness: 40 mil (1.02 mm) ASTM D3767 procedure A (Section 9.1).
4. Tensile Strength, Membrane: 250 psi (1720 kN/m2) ASTM D412 (Die C modified).
5. Elongation, Membrane: 250% ASTM D412 (Die C modified).
6. Low Temperature Flexibility: Unaffected @ -20°F (-29°C) ASTM D1970.
7. Adhesion to Plywood: 3.0 lbs/in. width (525 N/m) ASTM D903.
8. Permeance (Max): 0.05 Perms (2.9 ng/m2s Pa) ASTM E96.
9. Material Weight Installed (Max): 0.3 lb/ft2 (1.3 kg/m2) ASTM D461.
10. Primer: Water-based Perm-A-Barrier WB Primer by GCP Applied Technologies, Inc.
11. Code and Standards Compliance: Grace Ice and Water Shield meets the following:
    a. Underwriters Laboratories Inc. Class A fire classification under fiber-glass shingles and Class C under organic felt shingles (per ASTM E108/UL 790).
    b. Underwriters Laboratories Inc. Classified Sheathing Material Fire Resistance Classification with Roof Designs: P225, P227, P230, P237, P259, P508, P510, P512, P514, P701, P711, P717, P722, P723, P732, P734, P736, P742, P803, P814, P818, P824
    c. ICC ESR-1677 approval according to AC-48 Acceptance Criteria for Self-Adhered underlayments used as Ice Barriers.
    d. Miami-Dade County Code Report NOA 12-1115.02.
    e. Canadian Construction Materials Centre (CCMC) 13670-L
    f. City of Los Angeles RR 25330
    g. Florida State Approval Report No. FL289-R3

PART 3 — EXECUTION

3.1 EXAMINATION

A. Prior to start of installation, inspect existing conditions to ensure surfaces are suitable for installation of roofing underlayment. Verify flashing has been installed. Starting work indicates installers acceptance of existing conditions.

3.2 INSTALLATION

A. Installation: Install roofing underlayment on sloped surfaces at locations indicated on the Drawings, but not less than at hips, ridges, eaves, valleys, sidewalls and chimneys, and surfaces over interior space within 36 inches (914 mm) from the inside face of the exterior wall. Strictly comply with manufacturer's installation instructions including but not limited to the following:
    1. Schedule installation such that underlayment is covered by roofing within the published exposure limit of the underlayment.
    2. Do not install underlayment on wet or frozen substrates.
    3. Install when surface temperature of substrate is a minimum of 40 degrees F (5 degrees C) and rising.
    4. Remove dust, dirt, loose materials and protrusions from deck surface.
    5. Install membrane on clean, dry, continuous structural deck. Fill voids and damaged or unsupported areas prior to installation.
    6. Prime concrete and masonry surfaces using specified primer at a rate of 500-600 square feet per gallon (12-15 sqm/L). Priming is not required for other suitable clean and dry surfaces.
    7. Install membrane such that all laps shed water. Work from the low point to the high point of the roof at all times. Apply the membrane in valleys before the membrane is applied to the eaves. Following placement along the eaves, continue application of the membrane up the roof. Membrane may be installed either vertically or horizontally after the first horizontal course.
    8. Side laps minimum 3-1/2 inches (89 mm) and end laps minimum 6 inches (152 mm) following lap lines marked on underlayment.

9. Patch penetrations and damage using manufacturer's recommended methods.

3.3 CLEANING AND PROTECTION

A. Protection: Protect from damage during construction operations and installation of roofing materials. Promptly repair any damaged or deteriorated surfaces.

B. Repair minor damage to eliminate all evidence of repair. Remove and replace work which cannot be satisfactorily repaired in the opinion of the Architect.

C. Provide temporary protection to ensure work being without damage or deterioration at time of final acceptance. Remove protective film and reclean as necessary immediately before final acceptance

DIVISION 7: THERMAL AND MOISTURE PROTECTION
Section 07 31 00: Asphalt Shingles

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Asphalt roofing shingles.

B. Leak barrier and moisture shedding roof deck protection.

C. Metal flashing associated with shingle roofing.

D. Attic ventilation.

1.2 RELATED SECTIONS

A. Section 06 10 00 - Rough Carpentry: Framing, wood decking and roof sheathing.

B. Section 07 62 00 - Flashing and Sheet Metal: Sheet metal flashing not associated with shingle roofing; gutters and downspouts.

1.3 REFERENCES

A. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

B. ASTM B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

C. ASTM B 370 - Standard Specification for Copper Sheet and Strip for Building Construction.

D. ASTM C 1549 - Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer.

E. ASTM D 3018 - Standard Specification for Class A Asphalt Shingles Surfaced with Mineral Granules.

F. ASTM D 3161 - Standard Test Method for Wind-Resistance of Asphalt Shingles (Fan-Induced Method).

G. ASTM D 3462 - Standard Specification for Asphalt Shingles Made from Glass Felt and Surfaced with Mineral Granules.

H. ASTM D 4586 - Standard Specification for Asphalt Roof Cement, Asbestos-Free.

I. ASTM E 903 - Standard Test Method for Solar Absorption, Reflectance and Transmission of Materials Using Integrating Spheres.

J. UL 790 - Tests for Fire Resistance of Roof Covering Materials.

K. UL 997 - Wind Resistance of Prepared Roof Covering Materials.

1.4 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Manufacturer's data sheets on each product to be used, showing compliance with requirements.

C. Selection Samples: Two complete sets of color cards representing manufacturer's full range of available colors and patterns.

D. Manufacturer's installation instructions, showing required preparation and installation procedures.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the roofing system products specified in this section, with minimum of 25 years experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened labeled packaging until ready for installation.

B. Store products in a covered, ventilated area, at temperature not more than 110 degrees F (43 degrees C); do not store near steam pipes, radiators, or in sunlight.

C. Store bundles on flat surface to maximum height recommended by manufacturer; store rolls on end.

D. Store and dispose of solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: GAF Materials Corporation, Residential Roofing Products (basis of design) or approved equivalent.

B. Requests for substitutions will be considered in accordance with provisions of Section 01600.
   1. When submitting request for substitution, provide complete product data specified above under Submittals, for each substitute product.

2.2 SHINGLES

A. Self sealing, granule surfaced, asphalt shingle with a strong fiberglass reinforced Micro Weave(r) core and StainGuard(r) protection, which prevents pronounced discoloration from blue-green algae through formulation/unique blends of granules. Architectural laminate styling provides a wood shake appearance with a 5" or 5 5/8" exposure. Features the classic Natural Shadow(tm) effect. UL 790 Class A rated with UL 997 Wind Resistance Label; ASTM D 7158, Class H; ASTM D 3161, Type 1; ASTM D 3018, Type 1; ASTM D 3462; CSA 123.5-98; Dade County Approved, Florida Building Code Approved, Texas Dept of Insurance Approved, ICC Report Approval. Timberline Natural Shadow 30 yr Ltd Warranty Shingles, by GAF.

B. Color:
   1. As selected by Architect from manufacturer's full range.

2.3 HIP AND RIDGE SHINGLES

A. Distinctive vented hip and ridge cap shingle complementing the color of selected roof shingle. Each bundle covers approx. 20 lineal feet (6096 mm) with a 9 1/4 inch (235 mm)

exposure. Vented RidgeCrest(tm) ridge cap shingles by GAF.

2.4 UNDERLAYMENT

A. Leak Barrier:
1. Self-adhering, self sealing, bituminous leak barrier surfaced with a smooth polyethylene film. Superior elongation properties allow for maximum workability. Each Roll contains approx. 200 sf (18.5 sqm), 85 lbs (38.6 kg), 36 inches by 66.7 feet (914 mm by 20.33 m). 60 mils (1.5 mm). StormGuard Ultra-Flex by GAF.

B. Roof Deck Protection:
1. #30 Roofing Underlayment: Water repellent breather type cellulose fiber building paper. Meets or exceeds the requirements of ASTM D 4869 Type II.

2.5 ASSOCIATED PRODUCTS

A. Fasteners
1. Standard round wire shingle type, zinc-coated steel or aluminum; 10 to 12 gauge (3.416 mm to 2.657 mm for steel) (2.588 mm to 2.052 mm for aluminum), barbed or deformed shank, with heads 3/8 inch (9.5 mm) to 7/16 inch (11 mm) in diameter; length sufficient to penetrate at least 3/4 inch (19 mm) into solid wood or just through plywood or oriented strand board.

B. Roofing Cement:
1. General purpose asphalt roofing cement meeting the requirements of ASTM D 4586 Type I or II. Matrix Standard Plastic Roof Cement #203 by BMCA.

C. Metal Flashing:
1. 16 oz/sq ft (0.56 mm) copper sheet, complying with ASTM B 370.
2. Use metal flashings at:
a. Eave edges.
b. Rake edges.
c. Step flashing at chimneys, side walls and dormers.

2.6 VENTILATION

A. Ridge Vent:
1. Flexible ridge ventilator designed to allow the passage of air from attics. Provides 16.9 sq. inches (10903 sqmm) NFVA (Hand Nail) and 14.1 sq. inches (9097 sqmm) NFVA (Nail Gun) per lineal foot. Cobra Ridge Vent, by GAF.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until roof deck has been properly prepared.

B. If roof deck preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 REMOVAL OF EXISTING ROOFING

A. Remove all existing roofing down to the roof deck.

B. Verify that deck is dry, sound, clean and smooth, free of depressions, waves and projections.

C. Cover with sheet metal all holes over 1 inch (25 mm) diameter, cracks over 1/2 inch (12 mm)

in width, loose knots and excessively resinous areas.

D. Replace damaged deck with new materials.

3.3 PREPARATION

A. Clean deck surfaces thoroughly prior to installation of leak barrier and underlayment.

B. At areas to receive leak barrier, fill knot holes and cracks with latex filler.

C. Chimneys: Install crickets on the upslope side of any chimney located in the north, on a roof steeper than 6:12, or wider than 24 inches (610 mm).

3.4 UNDERLAYMENT INSTALLATION

A. Install using methods recommended by manufacturer in accordance with local building code.

B. Eaves:
1. Place eave edge metal flashing tight with fascia boards; lap joints 2 inches (50 mm) and seal with plastic cement; nail at top of flange.

C. Valleys:
1. Install leak barrier at least 36 inches wide centered on valley; lap ends 6 inches (150 mm) and seal.
2. Where valleys are indicated to be "open valleys", install metal flashing over leak barrier before roof deck underlayment is installed; DO NOT NAIL THROUGH flashing; secure by nailing at 18 inches (457 mm) on center just beyond edge of flashing so that nail heads hold down edge.

D. Roof Deck:
1. Install one layer of roof deck underlayment over entire area not protected by eave or valley membrane; run sheets horizontally lapped so water sheds; nail in place.
2. On roofs sloped at more than 4 in 12, lap horizontal edges at least 2 inches (50 mm) and at least 2 inches (50 mm) over eave protection membrane.
3. Lap ends at least 4 inches (100 mm); stagger end laps of each layer at least 36 inches (915 mm).
4. Lap underlayment over valley protection at least 6 inches (150 mm).

E. Penetrations:
1. At vent pipes, install a 24 inch (610 mm) square piece of leak barrier lapping over roof deck protection; seal tightly to pipe.
2. At vertical walls, install leak barrier extending at least 6 inches (150 mm) up the wall and 12 inches (305 mm) on to the roof surface lapping over roof deck protection.
3. At skylights and roof hatches, install leak barrier up the sides of the frame and 12 inches (305 mm) on to the roof surface on all sides, lapping over roof deck underlayment.
4. At chimneys, install leak barrier around entire chimney extending at least 6 inches (150 mm) up the wall and 12 inches (305 mm) on to the roof surface lapping over roof deck protection.

3.5 INSTALLATION OF SHINGLES

A. Install in accordance with manufacturer's instructions and requirements of local building code.
1. Avoid breakage of shingles by avoiding dropping bundles on edge, by separating shingles carefully (not by "breaking" over ridge or bundles), and by taking extra precautions in temperatures below 40 degrees F (4 degrees C).

2. Handle carefully in hot weather to avoid damaging shingle edges.
3. Secure with 4 to 6 nails per shingle; use number of nails required by manufacturer or by code, whichever is greater. Nails must be long enough to penetrate through plywood or OSB, or 3/4 inch (19 mm) into dimensional lumber.

B. Install hip and ridge shingles as required by the manufacturer.
1. At ridges, install hip and ridge shingles over ridge or ridge vent material.

3.6 VENTILATION

A. Ridge Vent:
1. Cut continuous vent slot through sheathing, stopping 6 inches (150 mm) from each end of ridge.
2. On roofs without ridge board, make slot 2 inches (50 mm) wide, centered on ridge.
3. On roofs with ridge board, make two slots 1-3/4 inches (89 mm) wide, one on each side.
4. Install ridge vent material full length of ridge, including uncut areas.
5. Butt ends of lengths of ridge vent material and join using plastic cement.
6. Install eave vents in sufficient quantity to equal or exceed the ridge vent area, calculated as specified by manufacturer.
7. Install ridge shingles over ridge vent material; use nails of specified length; do not drive nails home, leaving 3/4 inch (19 mm) slot open between ridge and roof shingles.

3.7 PROTECTION

A. Stage work progress so that traffic is minimized over completed roofing.

B. Protect installed products until project Final Acceptance.

END OF SECTION 07 31 00

SECTION 07 41 10 - STANDING-SEAM METAL ROOF PANELS

GENERAL: Drawings and any general provisions of the Contract for all Bid Items, including General and Supplementary Conditions and Program Manager's specific requirements apply to this section.

1.1 SUMMARY

A. Section includes standing-seam metal roof panels.

B. Related Sections:

1.2 SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches (1:10).

C. Samples for Initial Selection: For each type of metal panel indicated with factory-applied color finishes. Submit 3 inch (76.2 mm) by 6 inch (152.4 mm) sample for each exposed finish.

1.3 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including rupturing, cracking, or puncturing.
b. Deterioration of metals and other materials beyond normal weathering.

2. Warranty Period: Five years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 10 years from date of Substantial Completion.

3. General Contractor will furnish watertightness warranty for five years.

PART 2 - PRODUCTS

2.1 STANDING-SEAM METAL ROOF PANELS

A. General: Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates, and accessories required for weather tight installation.

1. Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E 1514.

2. Peterson Aluminum PAC-CLAD Tite Loc Plus, Basis of Design or approved equal.

2.2 UNDERLAYMENT MATERIALS

A. Felt Underlayment: ASTM D 226/D 22M, Type II (No. 30), asphalt-saturated organic felts.

B. Slip Sheet: Manufacturer's recommended slip sheet, of type required for application.

2.3 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C 645; cold-formed, metallic-coated steel sheet, ASTM A 653/A 653M, G90 (Z275 hot-dip galvanized) coating designation or ASTM A 792/A 792M, Class AZ50 (Class AZM150) coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal panels.
2. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

D. Gutters: Formed from same material as roof panels, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch- (2400-mm-) long sections, of size

and metal thickness according to SMACNA's "Architectural Sheet Metal Manual." Furnish gutter supports spaced a maximum of 36 inches (914 mm) o.c., fabricated from same metal as gutters. Provide wire ball strainers of compatible metal at outlets. Finish gutters to match metal roof panels.

E. Downspouts: Formed from same material as roof panels. Fabricate in 10-foot- (3-m-) long sections, complete with formed elbows and offsets, of size and metal thickness according to SMACNA's "Architectural Sheet Metal Manual." Finish downspouts to match gutters.

F. Panel Fasteners: Self-tapping screws designed to withstand design loads.

G. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
2. Joint Sealant: ASTM C 920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

2.4 FABRICATION

A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel. Panel width (spacing) shall be 18” on all Bid Items.

C. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
3. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
5. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.

a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal panel manufacturer for application, but not less than thickness of metal being secured.

2.5 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are unacceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Steel Panels and Accessories:

1. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
2. Three-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
3. Mica Fluoropolymer: AAMA 621. Two-coat fluoropolymer finish with suspended mica flakes containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
4. Metallic Fluoropolymer: AAMA 621. Three-coat fluoropolymer finish with suspended metallic flakes containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
5. FEVE Fluoropolymer: AAMA 621. Two-coat fluoropolymer finish containing 100 percent fluorinated ethylene vinyl ether resin in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
6. Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 0.8 mil (0.02 mm) for topcoat.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.
1. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal roof panel manufacturer.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLAYMENT INSTALLATION

A. Felt Underlayment: Apply in shingle fashion to shed water, and with lapped joints of not less than 2 inches (50 mm).

B. Slip Sheet: Apply slip sheet over underlayment before installing metal roof panels.

3.3 METAL PANEL INSTALLATION

A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving metal panels.
2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
3. Install screw fasteners in predrilled holes.
4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Install flashing and trim as metal panel work proceeds.
6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:

1. Steel Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.

C. Anchor Clips: Anchor metal roof panels and other components of the Work securely in place, using manufacturer's approved fasteners according to manufacturers' written instructions.

D. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

E. Standing-Seam Metal Roof Panel Installation: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended in writing by manufacturer.

1. Install clips to supports with self-tapping fasteners.
2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
3. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.

F. Clipless Metal Panel Installation: Fasten metal panels to supports with screw fasteners at each lapped joint at location and spacing recommended by manufacturer.

G. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal roof panel manufacturers; or, if not indicated, types recommended by metal roof panel manufacturer.

H. Gutters: Join sections with riveted and soldered or lapped and sealed joints. Attach gutters to eave with gutter hangers spaced not more than 36 inches (914 mm) o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.

I. Downspouts: Join sections with telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch (25 mm) away from walls; locate fasteners at top and bottom and at approximately 60 inches (1524 mm) o.c. in between.

3.4 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

B. Replace metal panels that have been damaged and protect from any damage until Final Acceptance.

END OF SECTION 07 41 10

DIVISION 07 00 00: THERMAL AND MOISTURE PROTECTION
Section 07 42 93: Metal Soffit Panels

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes Factory-formed metal soffits, including flashing and accessories.

B. Related Sections: Sections related to this section include:
1. Flashing and Trim: Division 07 Flashing and Sheet Metal Section.
2. Sealants: Division 07 Joint Sealants Section.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM):
1. ASTM B209 - Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

B. Underwriters Laboratories (UL Classified Tests):
1. UL 263 - Fire Tests of Building Construction and Materials
2. UL 2218 - Impact Resistance Test

1.03 SYSTEM DESCRIPTION

A. Performance Requirements: Provide sheet metal soffit that has been manufactured, fabricated and installed to withstand structural and thermal movement, wind loading and weather exposure to maintain manufacturer's performance criteria without defects, damage, failure or infiltration of water.
1. Wind-Uplift: Soffit panel assembly shall comply with UL Classification 580 for UL Classified 90 rated assemblies
2. Static Air Infiltration: Completed soffit system shall have a maximum of .06 cfm/sf with 6.24 kPa air pressure differential as per ASTM E283/1680.

1.04 SUBMITTALS

A. General: Submit listed submittals in accordance with Conditions of the Contract and Division 1 Submittal Procedures Section.
1. Product Data: Submit product data, including manufacturer's SPEC-DATA product sheet, for specified products.

B. Shop Drawings:
1. Submit complete shop drawings and erection details, approved by the metal soffit manufacturer, to the Architect for review. Do not proceed with manufacturer of soffit materials prior to review of shop drawings and field verification of all dimensions. Do not use drawings prepared by the Architect for shop or erection drawings.
2. Shop drawings showing soffit plans, methods of erection, and flashing details.

C. Performance Tests:
1. Submit certified test results by a recognized testing laboratory in accordance with specified test methods for each panel system.

D. Samples: Submit selection and verification samples for finishes, colors and textures.

E. Quality Assurance Submittals: Submit the following:
   1. Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and physical requirements.
   2. Manufacturer's Instructions: Manufacturer's installation instructions.

F. Closeout Submittals: Submit the following:
   1. Operation and Maintenance Data: Operation and maintenance data for installed products in accordance with Division 1 Closeout Submittals, Maintenance Data and Operation Data Section. Include methods for maintaining installed products and precautions against cleaning materials and methods detrimental to finishes and performance.
   2. Project Warranty: Warranty documents specified herein.
      A. Manufacturer's warranty: Submit, for owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to and not limited to, other rights the owner may have under the contract documents.

   3. Record Documents: Project record documents for installed materials in accordance with Division 1 Closeout Submittals, Project Record Documents Section.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Installer experienced in performing work of this section who has specialized in the installation of work similar to that required for this project.

B. Sheet Metal Industry Standard: Comply with Sheet Metal and Air Conditioning Contractors National Association (SMACNA) Architectural Sheet Metal Manual.

C. Pre-Installation Meetings: Conduct pre-installation meeting to verify project requirements, substrate conditions, manufacturer's installation instructions and manufacturer's warranty requirements. Comply with Division 1 Project Meetings Section.

1.06 DELIVERY, STORAGE AND HANDLING

A. General: Comply with Division 1 Product Requirements Sections.
   1. Ordering: Comply with manufacturer's ordering instructions and lead-time requirements to avoid construction delays.

B. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact. Identify fabricated components with UL 90 Classified label where appropriate.

C. Storage and Protection: Store materials protected from exposure to harmful conditions. Store material in dry, above ground location.
   1. Stack prefinished material to prevent twisting, bending, abrasion, scratching and denting. Elevate one end of each skid to allow for moisture to run off.
   2. Prevent contact with material that may cause corrosion, discoloration or staining.
   3. Do not expose to direct sunlight or extreme heat trim material with factory applied strippable film.

1.07 PROJECT CONDITIONS

A. Field Measurements: Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements, fabrication schedule with construction progress to avoid construction delays.

1.08 WARRANTY

A. Project Warranty: Refer to Conditions of the Contract for project warranty provisions.

B. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to and not a limitation of, other rights Owner may have under the Contract Documents.

PART 2 - PRODUCTS

2.01 SHEET METAL SOFFITS

A. Manufacturer: Petersen Aluminum Corporation (basis of design) or approved equal.

B. PAC-CLAD Soffit Panels:
1. Type: PAC-750 Soffit (Non-Vented) Panel
2. Material: .040in ga (.10 mm) alloy 3105-H14 Aluminum
3. Panel Dimension: 7in (178 mm) o.c.
4. Texture: Smooth

C. Panel Finish:
1. Panel Topside: PAC-CLAD finish color shall be selected by Architect from Petersen Aluminum Corporation (basis of design) standard colors.
2. Panel Underside: Polyester wash coat with dry film thickness of 0.3 mils.

D. PAC-CLAD Flashing and Trim: Manufacturer's standard flashing and trim profiles, factory formed, gauge as recommended by manufacturer, color and finish matching metal soffit panels.

2.03 FABRICATION

A. General:
1. Continuous Length: Fabricate panels 55' and less in one continuous length.
2. Trim and Flashings: Fabricate trim and flashings from same material as roof system material.
3. Portable Roll Former: Panels fabricated by portable roll former shall not be approved.

2.04 FINISHES

A. PAC-CLAD Factory Applied Finish:
1. Topside: Full-strength fluoropolymer (70% Kynar 500 or Hylar resin) system of 1.0 mil (.025 mm) total dry film thickness.

2. Underside: Wash coat of 0.3 - 0.4 mil dry film thickness.
3. Texture: (Smooth texture, dull matte specular gloss 25 - 35% at 60).
4. Protective film: Strippable vinyl film applied during panel fabrication and finishing.

PART 3 - EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

A. Compliance: Comply with manufacturer's product data, recommendations and installations instructions for substrate verification, preparation requirements and installation.
1. Strippable Film: Remove manufacturer's protective film, if any, from surfaces of soffit panels.

3.02 EXAMINATION

A. Site Verification of Conditions: Verify substrate conditions, which have been previously installed under other sections, are acceptable for project installation in accordance with manufacturer's instructions.

3.03 PREPARATION

A. Coordination: Coordinate metal soffit with other Work (flashing and trim, walls) and other adjoining work to provide a non-corrosive installation.

B. Dissimilar Metals: Prevent galvanic action of dissimilar metals.

3.04 INSTALLATION

A. General: Install metal soffit panels to profiles, patterns and drainage indicated. Provide for structural and thermal movement.
1. Seams: Provide uniform, neat seams.
2. Fasteners: Conceal fasteners where possible in exposed work.

3.05 FIELD QUALITY REQUIREMENTS

A. Site Tests (Post Installation Testing): Owner reserves right to perform post installation testing of installed sheet metal soffit.

3.06 CLEANING

A. Cleaning: Remove temporary coverings and protection of adjacent work areas. Repair or replace damaged installed products. Clean installed products in accordance with manufacturer's instructions prior to owner's final acceptance. Remove construction debris from project site and legally dispose of debris.

3.07 PROTECTION

A. Protection: Protect installed product from damage during construction.

END OF SECTION

SECTION 07 46 46
FIBER CEMENT SIDING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fiber cement lap siding, panels, shingle, trim, fascia, and accessories; James Hardie HZ10 Engineered for Climate Siding.

B. Factory-finished fiber cement, panels, , trim, fascia, and accessories; James Hardie HZ10 Engineered for Climate Siding.

1.2 RELATED SECTIONS

A. Section 05 40 00 - Cold-Formed Metal Framing.

B. Section 06 10 00 - Rough Carpentry.

C. Section 06 10 00 - Rough Carpentry.

D. Section 07 21 19 - Foamed-In-Place Insulation.

1.3 REFERENCES

A. ASTM D3359 - Standard Test Method for Measuring Adhesion by Tape Test, Tool, and Tape.

B. ASTM E136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 degrees C.

1.4 SUBMITTALS

A. Submit under provisions of Section 01 30 00 - Administrative Requirements.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

C. Shop Drawings: Provide detailed drawings of atypical non-standard applications of cementitious siding materials which are outside the scope of the standard details and specifications provided by the manufacturer.

D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

E. Verification Samples: For each finish product specified, two samples, minimum size 4 by 6 inches (100 by 150 mm), representing actual product, color, and patterns.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Minimum of 2 years' experience with installation of similar products.

B. Mock-Up: Provide a mock-up (4’ x 4’ minimum) for evaluation of surface preparation techniques and application workmanship.
   1. Finish areas designated by Architect.
   2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
   3. Remodel mock-up area as required to produce acceptable work.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store siding on edge or lay flat on a smooth level surface. Protect edges and corners from chipping. Store sheets under cover and keep dry prior to installing.

C. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.7 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside the manufacturer's absolute limits.

1.8 WARRANTY

A. Product Warranty: Limited, non-pro-rated product warranty.
   1. Hardie Panel HZ10 vertical siding for 30 years.
   2. Hardie Soffit HZ10 panels for 30 years.
   3. Hardie Trim HZ10 boards for 15 years.

B. Finish Warranty: Limited product warranty against manufacturing finish defects.
   1. When used for its intended purpose, properly installed and maintained according to Hardie's published installation instructions, James Hardie's ColorPlus finish with ColorPlus Technology, for a period of 15 years from the date of purchase: will not peel; will not crack; and will not chip. Finish warranty includes the coverage for labor and material.

C. Workmanship Warranty: Application limited warranty for 2 years.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Basis of Design or prior approved equivalent, James Hardie Building Products, Inc., which is located at: 303 E. Wacker Dr.; Chicago, IL 60601 ; Toll Free Tel: 877-236-7526; Email:request info (info@jameshardie.com); Web:https://www.jameshardiepros.com|https://www.jameshardie.com

B. Requests for approval of equal substitutions will be considered in accordance with the provisions of Section 01 60 00 - Product Requirements.

2.2 SIDING AND TRIM

A. Vertical Siding: Hardie Panel HZ10 siding as manufactured by James Hardie Building Products, Inc.

   1. Type: Stucco Vertical siding panel 4 feet by 9 feet (1219 mm by 2743 mm).

B. Soffit Panels: Hardie Soffit HZ10 Soffit Panel, as manufactured by James Hardie Building Products, Inc.
   1. Factory sealed on 5 sides.
   2. Thickness: 1/4 inch (6 mm).
   3. Type: Smooth, 24 inches (610 mm) by 8 feet (2438 mm).

C. Trim:
   1. Hardie Trim HZ10 boards as manufactured by James Hardie Building Products, Inc.
      a. Product: Batten Boards, 2-1/2 inch (63 mm) width.
      b. Product: 4/4 Boards, 3-1/2 inch (89 mm) width.
      c. Product: 4/4 Boards, 5-1/2 inch (140 mm) width.
      d. Product: 4/4 Boards, 7-1/4 inch (184 mm) width.
      e. Product: 4/4 Boards, 9-1/4 inch (235 mm) width.
      f. Product: 4/4 Boards, 11-1/4 inch (286 mm) width.
      g. Product: 4/4 NT3 Boards, 3-1/2 inch (89 mm) width.
      h. Product: 4/4 NT3 Boards, 5-1/2 inch (140 mm) width.
      i. Product: 4/4 NT3 Boards, 7-1/4 inch (184 mm) width.
      j. Product: 4/4 NT3 Boards, 9-1/4 inch (235 mm) width.
      k. Product: 4/4 NT3 Boards, 11-1/4 inch (286 mm) width.
      l. Texture: Smooth.
      m. Length: 12 feet (3658 mm).
      n. Thickness: 3/4 inch (19 mm).
      o. Thickness: 1 inch (24 mm).
   2. Hardie Trim HZ10 Fascia boards as manufactured by James Hardie Building Products, Inc.
   3. Fiber-cement trim - complies with ASTM C 1186 Type A Grade II.
   4. Fiber-cement trim - complies with ASTM E 136 as a noncombustible material.
   5. Fiber-cement trim - complies with ASTM E 84 Flame Spread Index = 0, Smoke Developed Index = 5.
   6. Intertek Product Listing.

2.3 FINISHES

A. Factory Primer: Provide factory applied universal primer.
   1. Primer: Factory primed by James Hardie.
   2. Topcoat: Refer to Section 09 90 00 - Painting and Coating and Exterior Finish Schedule.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until the substrates have been properly prepared.

B. If framing preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Nominal 2 inch by 4 inch (51 mm by 102 mm) wood framing selected for minimal shrinkage and complying with local building codes, including the use of water-resistive barriers or vapor barriers where required. Minimum 1-1/2 inches (38 mm) face and straight, true, of uniform dimensions and properly aligned.
   1. Install water-resistive barriers and claddings to dry surfaces.
   2. Repair any punctures or tears in the water-resistive barrier prior to the installation of the siding.
   3. Protect siding from other trades.

D. Minimum 20 gauge (1 mm) 3-5/8 inch (92 mm) C-Stud 16 inches maximum on center or 16 gauge (1.6 mm) 3-5/8 inches (92 mm) C-Stud 24 inches (610 mm) maximum on center metal framing complying with local building codes, including the use of water-resistive barriers and/or vapor barriers where required. Minimum 1-1/2 inches (38 mm) face and straight, true, of uniform dimensions and properly aligned.
   1. Install water-resistive barriers and claddings to dry surfaces.
   2. Repair any punctures or tears in the water-resistive barrier prior to the installation of the siding.
   3. Protect siding from other trades.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Install a water-resistive barrier is required in accordance with local building code requirements.

D. The water-resistive barrier must be appropriately installed with penetration and junction flashing in accordance with local building code requirements.

E. Install Engineered for Climate Hardie Weather Barrier in accordance with local building code requirements.

F. Use Hardie Weather Barrier Seam Tape and joint and laps.

G. Install and Hardie Weather Barrier flashing, Hardie Weather Barrier Flex Flashing.

3.3 INSTALLATION - HARDIE PANEL HZ10 VERTICAL SIDING

A. Install materials in strict accordance with manufacturer's installation instructions.

B. Install metal Z flashing and provide a 1/4 inch (6 mm) gap at horizontal panel joints.

C. Place fasteners no closer than 3/8 inch (9.5 mm) from panel edges and 2 inches (51 mm) from panel corners.

D. Allow minimum vertical clearance between the edge of siding and any other material in strict accordance with the manufacturer's installation instructions.

E. Maintain clearance between siding and adjacent finished grade.

F. Specific framing and fastener requirements refer to Tables 2 and 3 in National Evaluation Service Report No. NER-405.

G. Touch Up: Apply touch up paint to cut edges in accordance with manufacturer's printed instructions.
   1. Touch-up nicks, scrapes, and nail heads in pre-finished siding using the manufacturer's touch-up kit pen.
   2. Touch-up of nails shall be performed after application, but before plastic protection wrap is removed to prevent spotting of touch-up finish.
   3. Use touch-up paint sparingly. If large areas require touch-up, replace the damaged area with new pre-finished siding. Match touch up color to siding color through use of manufacturer's branded touch-up kits.

3.4 INSTALLATION - HARDIE SOFFIT HZ10 AND VENTED PANELS

A. Install materials in strict accordance with manufacturer's installation instructions.
   1. Panels may be installed as soffit or ceiling over wood or steel framing; 20 gauge (33 mils) minimum to 16 gauge (54 mils), complying with local building code. Install soffits to nominal 2 x 4 framing members spaced a maximum of 24 inches (610 mm) on center with the long dimension perpendicular to the rafter or joist framing.
   2. Support edges by framing.
   3. Install water barriers and air barriers as required by local building codes.
   4. Ensure gutters have end caps. Maintain a minimum 1 inch (25 mm) gap between end caps and siding and trim.
   5. Install kickout flashing at roof-wall junctions per manufacturer's instructions.
   6. Additional framing may be needed to ensure proper fastening.
   7. Position vent holes toward outside of eave for optimal airflow.
   8. Vents can be installed into non-vented soffit.
   9. Insect screen can be installed using construction adhesive.
   10. Fastener Positioning: Position fasteners 3/8 inches (9.5 mm) from panel edges and no closer than 2 inches (51 mm) away from corners when using soffit greater than 12 inch (305 mm) wide and no closer than 1 inch (25 mm) away from corners when using soffit that is less than or equal to 12 inch (305 mm) wide.
   11. Jointing Methods: Install panels in moderate contact at ends, provide PVC or metal jointers, battens or leave appropriate gap and caulk.
   12. Drive fasteners perpendicular to siding and framing.
   13. Fastener heads should fit snug against siding; no air space.

3.5 INSTALLATION - HARDIE TRIM HZ10 BOARDS

A. Install materials in strict accordance with manufacturer's installation instructions. Install flashing around all wall openings.

B. Fasten through trim into structural framing or code complying sheathing. Fasteners must penetrate a minimum of 3/4 inch (19 mm) or full thickness of sheathing. Additional fasteners may be required to ensure adequate security.

C. Place fasteners no closer than 3/4 inch (19 mm) and no further than 2 inches (51 mm) from side edge of trim board and no closer than 1 inch (25 mm) from end. Fasten maximum 16 inches (406 mm) on center.

D. Maintain clearance between trim and adjacent finished grade.

E. Trim inside corner with a single board trim both side of corner.

F. Outside Corner Board Attach Trim on both sides of corner with 16 gage corrosion resistant finish nail 1/2 inch (13 mm) from edge spaced 16 inches (406 mm) apart, weather cut each end spaced minimum 12 inches (305 mm) apart.

G. Allow 1/8 inch gap between trim and siding.

H. Seal gap with high quality, paint-able caulk.

I. Shim frieze board as required to align with corner trim.

J. Fasten through overlapping boards. Do not nail between lap joints.

K. Overlay siding with single board of outside corner board then align second corner board to outside edge of first corner board. Do not fasten HardieTrim boards to HardieTrim boards.

L. Shim frieze board as required to align with corner trim.

M. Install HardieTrim Fascia boards to rafter tails or to sub fascia.

3.6 FINISHING

A. Finish unprimed siding with a minimum one coat high quality, alkali resistant primer and one coat of either, 100 percent acrylic or latex or oil based, exterior grade topcoats or two coats high quality alkali resistant 100 percent acrylic or latex, exterior grade topcoat within 90 days of installation. Follow paint manufacturer's written product recommendation and written application instructions.

B. Finish factory primed siding with a minimum of one coat of high quality 100 percent acrylic or latex or oil based exterior grade paint within 180 days of installation. Follow paint manufacturer's written product recommendation and written application instructions.

3.7 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

DIVISION 07 00 00: THERMAL AND MOISTURE PROTECTION
Section 07 62 00: Flashing and Sheet Metal

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions apply to work of this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Metal counter flashing and base flashing (if any).
2. Metal wall flashing and expansion joints.
3. Miscellaneous sheet metal accessories.
4. Laminated and composition flashing.

B. Integral masonry flashings are specified as masonry work in sections of Division 4.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract.

B. Product data, Flashing, Sheet Metal, and Accessories: Manufacturer's technical product data, installation instructions and general recommendations for each specified sheet material and fabricated product.

C. Samples of the following flashing, sheet metal, and accessory items:

1. 8-inch-square samples of specified sheet materials to be exposed as finished surfaces.
2. 12-inch-long samples of factory-fabricated products exposed as finished work. Provide complete with specified factory finish.

D. Shop drawings showing layout, profiles, methods of joining, and anchorages details, including major counterflashings, trim/fascia units, and expansion joint systems. Provide layouts at 1/4-inch scale and details at 3-inch scale.

1.4 PROJECT CONDITIONS

A. Coordinate work of this section with interfacing and adjoining work for proper sequencing of each installation. Ensure best possible weather resistance and durability of work and protection of materials and finishes.

PART 2 - PRODUCTS

2.1 SHEET METAL FLASHING AND TRIM MATERIALS

A. Zinc-Coated Steel: Commercial quality with 0.20 percent copper, ASTM A 526 except ASTM A 527 for lock-forming, G90 hot-dip galvanized, mill phosphatized where indicated for painting;

0.0359-inch thick (20 gage) except as otherwise indicated.

B. Sheet Aluminum: ASTM B 209, alloy 3105, temper H14, with Kynar 500 or Hylar 5000 coating, thickness as indicated. Use for break metal where indicated.

2.2 LAMINATED COMPOSITION SHEET FLASHING (as required and/or indicated)

A. Copper/Paper Flashing: 3-oz. copper sheet laminated between 2 sheets of bituminous impregnated creped Kraft paper or saturated fabric.

B. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

1. Afco Products, Inc.; "Cop-A-Bond Duplex."
2. Phoenix Building Products, Inc.; "Duplex Cop-R Flash."
3. York Manufacturing, Inc.; "Cop-R-Tex Duplex."

C. Miscellaneous Materials and Accessories:

D. Solder: For use with steel or copper, provide 50 - 50 tin/lead solder (ASTM B 32), with rosin flux.

E. Fasteners: Same metal as flashing/sheet metal or other non- corrosive metal as recommended by sheet manufacturer. Match finish of exposed heads with material being fastened.

F. Bituminous Coating: SSPC - Paint 12, solvent-type bituminous mastic, nominally free of sulfur, compounded for 15-mil dry film thickness per coat.

G. Mastic Sealant: Polyisobutylene; nonhardening, nonskinning, non- drying, nonmigrating sealant.

H. Elastomeric Sealant: Generic type recommended by manufacturer of metal and fabricator of components being sealed and complying with requirements for joint sealants as specified in Division 7 Section "Joint Sealers."

I. Epoxy Seam Sealer: 2-part noncorrosive metal seam cementing compound, recommended by metal manufacturer for exterior/interior nonmoving joints including riveted joints.

J. Adhesives: Type recommended by flashing sheet manufacturer for waterproof/weather-resistant seaming and adhesive application of flashing sheet.

K. Paper Slip Sheet: 5-lb. rosin-sized building paper.

L. Polyethylene Underlayment: Minimum 6-mil carbonated polyethylene film resistant to decay when tested in accordance with ASTM E 154.

M. Reglets: Metal or plastic units of type and profile indicated, compatible with flashing indicated, noncorrosive.

N. Metal Accessories: Provide sheet metal clips, straps, anchoring devices, and similar accessory units as required for installation of work, matching or compatible with material being installed, noncorrosive, size and gage required for performance.

O. Elastic Flashing Filler: Closed-cell polyethylene or other soft closed-cell material recommended by elastic flashing manufacturer as filler under flashing loops to ensure movement with minimum stress on flashing sheet.

P. Roofing Cement: ASTM D 2822, asphaltic.

2.3 FABRICATED UNITS

A. General Metal Fabrication: Shop-fabricate work to greatest extent possible. Comply with details shown and with applicable requirements of SMACNA "Architectural Sheet Metal Manual" and other recognized industry practices. Fabricate for waterproof and weather-resistant performance, with expansion provisions for running work, sufficient to permanently prevent leakage, damage, or deterioration of the work. Form work to fit substrates. Comply with material manufacturer instructions and recommendations for forming material. Form exposed sheet metal work without excessive oil-canning, buckling, and tool marks, true to line and levels indicated, with exposed edges folded back to form hems.

B. Seams: Fabricate nonmoving seams in sheet metal with flat-lock seams. For metal other than aluminum, tin edges to be seamed, form seams, and solder. Form aluminum seams with epoxy seam sealer; rivet joints for additional strength where required.

C. Expansion Provisions: Where lapped or bayonet-type expansion provisions in work cannot be used or would not be sufficiently water/weatherproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

D. Sealant Joints: Where movable, nonexpansion type joints are indicated or required for proper performance of work, form metal to provide for proper installation of elastomeric sealant, in compliance with SMACNA standards.

E. Separations: Provide for separation of metal from noncompatible metal or corrosive substrates by coating concealed surfaces at locations of contact, with bituminous coating or other permanent separation as recommended by manufacturer/fabricator.

F. Aluminum Extrusion Units: Fabricate extruded aluminum running units with formed or extruded aluminum joint covers for installation behind main members where possible. Fabricate mitered and welded corner units.

PART 3 - EXECUTION

3.1 INSTALLATION REQUIREMENTS

A. General: Except as otherwise indicated, comply with manufacturer's installation instructions and recommendations and with SMACNA "Architectural Sheet Metal Manual." Anchor units of work securely in place by methods indicated, providing for thermal expansion of metal units; conceal fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weatherproof.

B. Underlayment: Where stainless steel or aluminum is to be installed directly on cementitious or wood substrates, install a slip sheet of red rosin paper and a course of polyethylene underlayment.

C. Bed flanges of work in a thick coat of bituminous roofing cement where required for waterproof performance.

D. Install reglets to receive counterflashing in manner and by methods indicated. Where shown in concrete, furnish reglets to trades of concrete work for installation as work of Division 3 sections. Where shown in masonry, furnish reglets to trades of masonry work, for installation as work of Division 4 sections.

E. Install counterflashing in reglets, either by snap-in seal arrangement or by welding in place for anchorage and filling reglet with mastic or elastomeric sealant, as indicated and depending on degree of sealant exposure.

F. Install elastic flashing in accordance with manufacturer's recommendations. Where required, provide for movement at joints by forming loops or bellows in width of flashing. Locate cover or filler strips at joints to facilitate complete drainage of water from flashing. Seam adjacent flashing sheets with adhesive, seal and anchor edges in accordance with manufacturer's recommendations.

G. Nail flanges of expansion joint units to curb nailers, at maximum spacing of 6 inches o.c. Fabricate seams at joints between units with minimum 3-inch overlap, to form a continuous, waterproof system.

3.2 CLEANING AND PROTECTION

A. Clean exposed metal surfaces, removing substances that might cause corrosion of metal or deterioration of finishes.

B. Protection: Advise Contractor of required procedures for surveillance and protection of flashings and sheet metal work during construction to ensure that work will be without damage or deterioration other than natural weathering at time of Final Acceptance.

END OF SECTION

DIVISION 07 00 00: THERMAL AND MOISTURE PROTECTION
Section 07 71 23: Gutters and Downspouts

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and any general provisions of the Contract, including General and Supplementary Conditions specific requirements apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Prefinished metal gutters and downspouts (exterior rain drainage).

B. Exposed Preformed, Prefinished Gutters and Downspouts shall be 20 gauge (minimum) aluminum. See 2.1, A. below.

a. Finishes General: Apply coatings either before or after forming and fabricating metal, as required by coating process and as required for maximum coating performance capability. Protect coating either by application of strippable film or by packing plastic film or other suitable material between panels in a manner to properly protect the finish. Furnish air-drying spray finish in matching color for touch-up.

(1) Color: As selected by the Architect from manufacturer’s full range of colors.

b. Fluoropolymer Coating: Manufacturer’s standard two-coat, thermo-cured, full-strength 70 percent “Kynar 500” or equal coating consisting of a primer and a minimum 0.75-mil dry film thickness with a total minimum dry film thickness of 0.9 mil and 30 percent reflective gloss when tested in accordance with ASTM D 523.

(1) Durability: Provide coating that has been field tested under normal range of weathering conditions for minimum of 20 years without significant peel, blister, flake, chip, crack or check in finish; without chalking in excess of No. 8 in accordance with ASTM D 659; and without fading in excess of 5 NBS units.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract.

B. Product data, Flashing, Sheet Metal, and Accessories: Manufacturer's technical product data, installation instructions and general recommendations for each specified sheet material and fabricated product.

C. Samples of the following flashing, sheet metal, and accessory items:

1. 8-inch-square samples of specified sheet materials to be exposed as finished surfaces.
2. 12-inch-long samples of factory-fabricated products exposed as finished work. Provide complete with specified factory finish.

D. Shop drawings showing layout, profiles, methods of joining, and anchorages details, including

flashings, trim units, gutters and downspouts. Provide layouts at 1/4-inch scale and details at 3-inch scale.

1.4 PROJECT CONDITIONS

A. Coordinate work of this section with interfacing and adjoining work for proper sequencing of each installation. Ensure best possible weather resistance and durability of work and protection of materials and finishes.

PART 2 - PRODUCTS

2.1 SHEET METAL FLASHING AND TRIM MATERIALS

A. Sheet Aluminum: ASTM B 209, alloy 3003, temper H14, finished with Galvalume (55% aluminum 45% zinc alloy) applied by continuous hot dip method (Triple spot minimum 0.55 ounce per square foot per ASTM A-792, 0.032-inch thick (20 gage) except as otherwise indicated. Use for gutters and downspouts.

2.2 FABRICATED UNITS

A. General Metal Fabrication: Shop-fabricate work to greatest extent possible. Comply with details shown and with applicable requirements of SMACNA "Architectural Sheet Metal Manual" and other recognized industry practices. Fabricate for waterproof and weather-resistant performance, with expansion provisions for running work, sufficient to permanently prevent leakage, damage, or deterioration of the work. Form work to fit substrates. Comply with material manufacturer instructions and recommendations for forming material. Form exposed sheet metal work without excessive oil-canning, buckling, and tool marks, true to line and levels indicated, with exposed edges folded back to form hems.

B. Seams: Fabricate nonmoving seams in sheet metal with flat-lock seams. For metal other than aluminum, tin edges to be seamed, form seams, and solder. Form aluminum seams with epoxy seam sealer; rivet joints for additional strength where required.

C. Expansion Provisions: Where lapped or bayonet-type expansion provisions in work cannot be used or would not be sufficiently water/weatherproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

D. Sealant Joints: Where movable, non-expansion type joints are indicated or required for proper performance of work, form metal to provide for proper installation of elastomeric sealant, in compliance with SMACNA standards.

E. Separations: Provide for separation of metal from non-compatible metal or corrosive substrates by coating concealed surfaces at locations of contact, with bituminous coating or other permanent separation as recommended by manufacturer/fabricator.

F. Aluminum Extrusion Units: Fabricate extruded aluminum running units with formed or extruded aluminum joint covers for installation behind main members where possible. Fabricate mitered and welded corner units.

PART 3 - EXECUTION

3.1 INSTALLATION REQUIREMENTS

A. General: Except as otherwise indicated, comply with manufacturer's installation instructions and recommendations and with SMACNA "Architectural Sheet Metal Manual." Anchor units of work securely in place by methods indicated, providing for thermal expansion of metal units; conceal fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weatherproof.

B. Underlayment: Where stainless steel or aluminum is to be installed directly on cementitious or wood substrates, install a slip sheet of red rosin paper and a course of polyethylene underlayment.

C. Bed flanges of work in a thick coat of bituminous roofing cement where required for waterproof performance.

D. Install continuous gutter guards on gutters, arranged as hinged units to swing open for cleaning gutters. Install "beehive"-type strainer-guard at conductor heads, removable for cleaning downspouts.

3.2 CLEANING AND PROTECTION

A. Clean exposed metal surfaces, removing substances that might cause corrosion of metal or deterioration of finishes.

B. Protection: Advise General Contractor of required procedures for surveillance and protection of sheet metal work during construction to ensure that work will be without damage or deterioration other than natural weathering at time of Final Acceptance.

END OF SECTION

DIVISION 07 00 00: Thermal and Moisture Protection
Section 07 92 00: Joint Sealants

Part 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and any general provisions of Contract including General and Supplementary Conditions.

1.2 SUMMARY:

A. This Section includes joint sealants for the following locations:

1. Exterior joints in vertical surfaces and nontraffic horizontal surfaces as indicated below:

a. Control and expansion joints in cast-in-place concrete.
b. Control and expansion joints in unit masonry.
c. Joints between different materials listed above.
d. Control and expansion joints in ceiling and overhead surfaces.
e. Other joints as indicated.
f. These applications shall use silicone sealant specified in 2.1.

2. Exterior joints in horizontal traffic surfaces as indicated below:

a. Control, expansion and isolation joints in cast-in-place concrete slabs.
b. Joints between different materials listed above.
c. Other joints as indicated.
d. These applications shall use polyurethane sealant specified in 2.1.

3. Interior joints in vertical surfaces and horizontal nontraffic surfaces as indicated below:

a. Control and expansion joints on exposed interior surfaces of exterior walls.
b. Perimeter joints of exterior openings where indicated.
c. Joints between tops of non-load-bearing unit masonry walls and underside of cast-in-place concrete slabs and beams.
d. Vertical control joints on exposed surfaces of interior unit masonry and concrete walls and partitions.
e. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
f. Perimeter joints of toilet fixtures.
g. Other joints as indicated.
h. These applications shall use silicone sealant specified in 2.1.

4. Interior joints in horizontal traffic surfaces as indicated below:

a. Control and expansion joints in cast-in-place concrete slabs.
b. Other joints as indicated.

c. These applications shall use polyurethane sealant specified in 2.1.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 7 Section "Flashing and Sheet Metal" for sealing joints related to flashing and sheet metal for roofing.

1.3 SYSTEM PERFORMANCE REQUIREMENTS:

A. Provide elastomeric joint sealants that have been produced and installed to establish and to maintain watertight and airtight continuous seals without causing staining or deterioration of joint substrates.

B. Provide joint sealants for interior applications that have been produced and installed to establish and maintain airtight continuous seals that are water resistant and cause no staining or deterioration of joint substrates.

1.4 SUBMITTALS:

A. General: Submit the following in accordance with Conditions of Contract.

B. Product data from manufacturers for each joint sealant product required.

C. Samples for verification purposes of each type and color of joint sealant required. Install joint sealant samples in 1/2-inch-wide joints formed between two 6-inch-long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

D. Certificates from manufacturers of joint sealants attesting that their product complies with specification requirements and are suitable for the use indicated.

E . Product test reports for each type of joint sealants indicated, evidencing compliance with requirements specified.

1.5 QUALITY ASSURANCE:

A. Installer Qualifications: Engage an experienced installer who has completed joint sealant applications similar in material, design, and extent to that indicated for Project that have resulted in construction with a record of successful in-service performance.

B. Single Source Responsibility for Joint Sealant Materials: Obtain joint sealant materials from a single manufacturer for each different product required.

1.6. DELIVERY, STORAGE, AND HANDLING:

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use,

pot life, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials in compliance with manufacturer's recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants or other causes.

1.7 PROJECT CONDITIONS:

A. Environmental Conditions: Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside the limits permitted by joint sealant manufacturer.

2. When joint substrates are wet.

B. Joint Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than allowed by joint sealant manufacturer for application indicated.

C. Joint Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with their adhesion are removed from joint substrates.

1.8 SEQUENCING AND SCHEDULING:

A. Sequence installation of joint sealants to occur not less than 21 nor more than 30 days after completion of waterproofing, unless otherwise indicated.

2.1 PRODUCTS

A. MATERIALS, GENERAL:

1. VOC Content of Interior Sealants and Sealant Primers: Comply with the following limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

a. Sealants: Not more than 250 g/L.
b. Sealant Primers for Nonporous Substrates: Not more than 250 g/L.
c. Sealant Primers for Porous Substrates: Not more than 775 g/L.

2. Compatibility: Provide joint sealants, joint fillers, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

3. Colors: Provide color of exposed joint sealants to comply with the following:

Provide selections made by Architect from manufacturer's full range of standard colors for products of type indicated.

B. POLYURETHANE AND SILICONE JOINT SEALANTS:

1. Polyurethane Joint Sealant: Manufacturer's standard, multi-component, chemically curing, self-leveling, non-sag, polyurethane sealant specially formulated for use in moving joints ¼" and greater, conforming to ASTM C920, Type M, Grade NS, Class 25.

2. Silicone Joint Sealant: Manufacturer's standard, one-part, neutral-curing, ultra low-modulus silicone sealant.

3. Products: Subject to compliance with requirements, provide one of the following or an approved equal:

a. Polyurethane Joint Sealant:

1. THC 901 by Tremco, Inc.

b. Silicone Joint Sealant:

1. Pecora 890 by Pecora Corporation.

C. JOINT SEALANT BACKING:

1. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers and other joint filler, and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

2. Plastic Foam Joint Filler: Preformed, compressible, resilient, nonstaining, nonwaxing, nonextruding stripes of flexible plastic foam of material indicated below and of size, shape and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

Open-cell polyurethane foam.

D. MISCELLANEOUS MATERIALS:

1. Primer: Material recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint sealant-substrate tests and field tests.

2. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealants backing materials, free of oily residues or other substances capable of staining or harming in any way joint substrates and adjacent nonporous surfaces, and formulated to promote optimum adhesion of sealants with joint substrates.

3. Masking Tape: Non-staining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

3.1 EXECUTION

A. EXAMINATION:

1. Examine joints indicated to receive joint sealants with installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint sealant performance. Do not proceed with installation of joint sealants until unsatisfactory conditions have been corrected.

B. PREPARATION:

1. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with recommendations of joint sealant manufacturer and the following requirements:

a. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

b. Clean concrete, masonry, unglazed surfaces of ceramic tile, and similar porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.

c. Remove laitance and form release agents from concrete.

d. Clean metal, glass, porcelain enamel, glazed surfaces of ceramic tile, and other nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.

2. Joint Priming: Prime joint substrates where indicated or where recommended by joint sealant manufacturer based on preconstruction joint sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's recommendations. Confine primers to areas of joint sealant bond; do not allow spillage or migration onto adjoining surfaces.

3. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

C. INSTALLATION OF JOINT SEALANTS:

1. General: Comply with joint sealant manufacturer's printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply.

2. Sealant Installation Standard: Comply with recommendations of ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

3. Acoustical Sealant Application Standard: Comply with recommendations of ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.

4. Installation of Sealant Backings: Install sealant backings to comply with the following requirements:

Install joint filler of type indicated to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

a. Do not leave gaps between ends of joint fillers.

b. Do not stretch, twist, puncture, or tear joint fillers.

c. Remove absorbent joint fillers that have become wet prior to sealant application and replace with dry material.

5. Installation of Sealants: Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability. Install sealants at the same time sealant backings are installed.

6. Tooling of Nonsag Sealants: Immediately after sealant applications and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated, to eliminate air pockets, and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

7. Provide concave joint configuration per Figure 5A in ASTM C 962, unless otherwise indicated.

D. CLEANING:

1. Clean off excess sealants or sealant smears adjacent to joints as work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

E. PROTECTION:

1. Protect joint sealants during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Final Acceptance. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so that installations with repaired areas are indistinguishable from original work.

END OF SECTION

SECTION 08 10 00
FIBERGLASS DOORS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Entry Doors of the Following Types:
   1. Fiberglass Entry Doors.
   2. Flush Panel Fiberglass Doors.

1.2 RELATED SECTIONS

A. Section 06 40 00 - Architectural Woodwork.

B. Section 07 25 00 - Air Barriers.

C. Section 07 92 00 – Joint Sealants.

D. Section 08 70 00 - Hardware.

1.3 REFERENCES

A. American National Standards Institute (ANSI):
   1. ANSI/BHMA A156.15-2014 - Hardware preparation in Steel Doors and Steel Frames.
   2. ANSI/SDI Standard A224.1 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors & Frames.

B. ASTM International (ASTM):
   1. ASTM A653 / A653-M - Standard Specification for Steel Sheet Zinc Coated (Galvanized) of Zinc-Iron Alloy Coated (Galvanealed) by the Hot Dip Process.
   2. ASTM A924 / 924-M-14 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot Dip Process.
   3. ASTM A1008 / A1008M-13 - 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.
   4. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus.
   5. ASTM D610 - Standard Practice for Evaluating Degree of Rusting on Painted Steel Surfaces.
   6. ASTM D714 - Standard Test Method for Evaluating Degree of Blistering of Paints.
   7. ASTM D1654 - Standard Test Method for Evaluation of Painted or Coated Specimens Subject to a Corrosive Environment.
   8. ASTM D1735 - Standard Practice for Testing Water Resistance of Coatings Using Water Fog Apparatus
   9. ASTM D3363 - Standard Test Method for Film Hardness by Pencil Test
   10. ASTM E331 - Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
   11. ASTM E413 - Classification for Rating Sound Insulation (STC).
   12. ASTM E547 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Cyclic Static Air Pressure Difference.
   13. ASTM E1332 - Standard Classification for Determination of Outdoor-Indoor Transmission Class.

C. Canadian Standard (CAN):
   1. CAN4-S104 - Standard Method for Fire Tests of Door Assemblies.

D. Environmental Protection Agency and Department of Energy (EPA):
   1. Energy Star Program Requirements Product Specification for Residential Windows, Doors, and Skylights.

E. Housing and Urban Development (HUD):
   1. HUD UM89 - HUD Building Product Standards and Certification Program for Exterior Insulated Steel Door Systems.

F. Intertek Testing Services, Warnock Hersey:
   1. WHI Directory of Positive Pressure Rated Door assemblies and components.

G. National Fenestration Rating Council (NFRC):
   1. NFRC 400 - Procedure for Determining Fenestration Product Air Leakage.

H. National Fire Protection Association (NFPA):
   1. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies.

I. Underwriters Laboratory (UL):
   1. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies.

1.4 SUBMITTALS

A. Submit under provisions of Section 01 30 00 - Administrative Requirements.

B. Product Data:
   1. Manufacturer's data sheets on each product to be used.
   2. Preparation instructions and recommendations.
   3. Storage and handling requirements and recommendations.
   4. Typical installation methods.

C. Verification Samples: Two representative units of each type, size, pattern and color.

D. Shop Drawings: Include dimensions, construction, component connections, anchorage methods and locations, accessories, hardware locations, and installation details.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with a minimum five years documented experience.

B. Installer Qualifications: Company specializing in performing Work of this section with minimum two years documented experience with projects of similar scope and complexity.
   1. Installer shall be certified by Manufacturer.

C. Source Limitations: Provide each type of product from a single manufacturing source to ensure uniformity.

D. Mock-Up: Construct a mock-up with actual materials in sufficient time for Architect's review and to not delay construction progress. Locate mock-up as acceptable to Architect and provide temporary foundations and support.
   1. Intent of mock-up is to demonstrate quality of workmanship and visual appearance.
   2. If mock-up is not acceptable, rebuild mock-up until satisfactory results are achieved.
   3. Retain mock-up during construction as a standard for comparison with completed work.
   4. Do not alter or remove mock-up until work is completed or removal is authorized.

1.6 PRE-INSTALLATION CONFERENCE

A. Convene a conference approximately two weeks before scheduled commencement of the Work. Attendees shall include Architect, Contractor and trades involved. Agenda shall include schedule, responsibilities, critical path items and approvals.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store and handle in strict compliance with manufacturer's written instructions and recommendations.

B. Protect from damage due to weather, excessive temperature, and construction operations.

1.8 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.9 WARRANTY

A. Manufacturer's standard limited warranty for fiberglass door product and genuine manufacturer components, including rot-resistant frames, mullions, and brickmould sourced from manufacturer (excluding primed pine door frames and oak door frames, and non-rot resistant mullions and brickmould) used in commercial and multi-residential projects will be free from material and workmanship defects for a period of three years subject to certain limitations and restrictions.

B. Finish Limited Warranty Rider providing coverage to the Warranty Holder for non-conformities in select stain and paint finishes.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Therma-Tru Corp., which is located at: 1750 Indian Wood Circle; Maumee, OH 43537; ASD Toll Free: 800-346-9141; Phone: 260-868-5811; Fax: 800-393-3533; Email: rclark@thermatru.com; Web: www.thermatru.com., Basis of Design or prior approved equivalent

B. Requests for substitutions will be considered in accordance with provisions of Product Requirements and Substitution Procedures

2.2 FIBERGLASS ENTRY DOORS

A. Performance Requirements:
1. Standards Compliance: Energy Star Rated.
2. Door Unit Air Leakage, NFRC 400 at 1.57 psf (75 Pa): Maximum 0.50 cfm (14 L/min) per square foot (0.09 square meter) of frame.
3. Door Unit Water Penetration, ASTM E331 or ASTM E547: No water penetration through door unit with water applied at rate of 5 gallons (19 Liters) per hour per square foot (0.09 square meters) at 0 psf (0 Pa).
4. Positive Pressure Fire Door Rating, CAN4 S104, NFPA 252 and UL 10C
5. Maximum U-Value
6. Maximum SHGC

B. Basis of Design: Classic-Craft; as manufactured by Therma-Tru Corp.
   1. Construction: Proprietary fiberglass-reinforced thermoset composite:
      a. Thickness: 3/32-inch (2.4 mm) minimum.
      b. Surface: AccuGrain Fir Grain textured to duplicate hand-crafted hardwood master.
      c. Door Edges: Moisture and Decay Resistant Composite.
      d. Door Bottom Edge: Moisture- and decay-resistant composite.
      e. Core: Foamed-in-place polyurethane, density 1.9 pcf (30 kg/cu.m.) minimum

      f. Call Width : 2'0"
         Call Height : 6'8"
         Line : Classic Craft® Fir Grain
         Glass Shape : Full Lite
         Style Shape : Full Lite Shaker Flush-Glazed
         Glass Type : Clear Glass
         Glass Design : Clear
         Grille Pattern : None
         Grille Style : None
         Low-E? : Yes
         Caming : None
         Frame Profile : None
         Door Prefinish : Unfinished
         Jamb Prefinish : Unfinished
         Hinges: Brushed Nickel
         Hardware : See Hardware Schedule

C. Basis of Design: Smooth Star as manufactured by Therma-Tru Corp.

   Call Width : 2'0"
   Call Height : 6'8"
   Door Collection : Smooth-Star®
   Line : Smooth-Star®
   Glass Shape : No Glass
   Style Shape : Flush Panel
   Glass Type : No Glass
   Glass Design : None
   Grille Pattern : None
   Grille Style : None
   Low-E? : No
   Caming : None
   Frame Profile : None
   Door Prefinish : Unfinished
   Jamb Prefinish : Unfinished

   Hinges: Brushed Nickel
   Hardware : See Hardware Schedule

D. Sills:
   1. Inswing: Composite adjustable.
   2. Other: Public access sill.
   3. Finish: Mill.
   4. Finish: Aluminum.

E. Factory Glazed:
   1. Type: Double-pane. Tempered

F. Glazing:
1. Inserts: Perimeter frames in raised-molding patterns, molded from composite, wood-grained in natural hardwood patterns, paintable, screw-fastened to doors, screw holes concealed with grained plugs in matching material.
2. Tested to withstand high service temperatures resulting from exposure behind storm doors or dark finishes.
3. Glass: Minimum 1/8 inch (3 mm) tempered, two panes with sealed airspace between, airspace typically 1/4 to 3/4 inch (6 to 13 mm).

2.3 FRAMES

A. Frames, Basis of Design: TRU-GUARD Rot Resistant - frames, mullions, and brickmould; as supplied by Therma-Tru Corp:
1. Surface: Buff Grained.
2. Surface: Smooth White.
3. Jamb Width: 4 9/16 inches (116 mm).
4. Jamb Width: 5 1/4 inches (133 mm).
5. Jamb Width: 6 9/16 inches (167 mm).

2.4 HARDWARE

A. Hinges:
1. Material: Steel
2. Size: 4 x 4 x 0.098 inches (102 x 102 x 2.5 mm)
3. Type: Adjustable:
a. Finish: Brushed Nickel
b. Plated screws to match.

B. Adjustable Security Strike Plate, for latch and deadbolt:
1. Finish: Oil Rubbed Bronze US10B.

C. Locking Hardware:
a. Schlage – see hardware schedule

2.5 INSTALLATION ACCESSORIES

A. Sill pan.

B. Corner seal pad.

C. Rain deflector.

D. Rain Guard.

E. Sill Cover.

2.6 FINISHES

A. Finish: Field finished in accordance with Section 09 90 00 - Painting and Coating.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly constructed and prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect in writing of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions, approved submittals, and in proper relationship with adjacent construction.
   1. Maintain alignment and compatibility with adjacent work.
   2. Steel Frame Installation: To be plumb, straight and true, rigidly secured in place, and properly braced.
   3. Comply with the Following:
      a. Manufacturer's installation instructions
      b. ANSI/DHIA115-IG installation guide.
      c. Door and Hardware Institute (DHI) installation standards.
      d. Steel Door Institute (SDI) installation and maintenance standards.

3.4 FIELD QUALITY CONTROL

A. Field Inspection: Coordinate field inspection in accordance with appropriate sections in Division 01.

B. Manufacturer's Services: Coordinate manufacturer's services in accordance with appropriate sections in Division 01.

3.5 CLEANING AND PROTECTION

A. Clean products in accordance with the manufacturer's recommendations.

B. Touch-up, repair or replace damaged products before Substantial Completion.

C. Protect installed products until completion of project.

END OF SECTION

DIVISION 08 00 00: OPENINGS
Section 08 11 13.13: Standard Hollow Metal Doors and Frames

PART I. - GENERAL

1.01. RELATED DOCUMENTS

a. Drawings and general provisions of Contract, including General and Supplementary Conditions apply to this Section.

1.02. SUMMARY

a. This Section includes the following products manufactured in accordance with SDI Recommended Standards:

1. Doors: Flush, hollow or composite construction standard steel doors for interior and exterior locations.
2. Frames: Pressed steel frames for doors, transoms, sidelights, mullions, interior glazed panels, and other interior and exterior openings of following type:

a. Welded unit type.

3. Assemblies: Provide standard steel door and frame assemblies as required for the following:

a. Labeled and fire rated. All labels shall be metal with raised embossed text and mechanically attached to the rated doors and frames.

4. Provide factory primed doors and frames to be field painted.

b. Painting primed doors and frames is specified in Division 9 Section "Painting."

c. Door hardware is specified in another Division 8 Section.

d. Glass and Glazing are specified in another Division 8 Section.

1.03 SUBMITTALS

a. General: Submit the following in accordance with Conditions of Contract.

b. Product data for each type of door and frame specified, including details of construction, materials, dimensions, hardware preparation, core, label compliance, sound ratings, profiles, and finishes.

c. Shop drawings showing fabrication and installation of standard steel doors and frames. Include details of each frame type, elevations of door design types, conditions at openings, details of construction, location and installation requirements of door and frame hardware and reinforcements, and details of joints and connections. Show anchorage and accessory items.

1. Provide schedule of doors and frames using same reference numbers for details and openings as those on contract drawings.
2. Indicate coordinate of glazing frames and stops with glass and glazing requirements.

d. Label Construction Certification: For door assemblies required to be fire-rated and exceeding limitations of labeled assemblies, submit manufacturer's certification that each door and frame assembly has been constructed to conform to design, materials and construction equivalent to requirements for labeled construction.

1.04 QUALITY ASSURANCE

a. Provide doors and frames complying with Steel Door Institute "Recommended Specifications Standard Steel Doors and Frames" ANSI/SDI-100 and as herein specified.

b. Fire-Rated Door Assemblies: Units that comply with NFPA 80, are identical to door and frame assemblies whose fire resistance characteristics have been determined per ASTM E 152 and which are labeled and listed by UL, Factory Mutual, Warnock Hersey, or other testing and inspecting organization acceptable to authorities having jurisdiction.

1. Temperature Rise Rating: At stairwell enclosures, provide doors which have Temperature Rise Rating of 450 deg F (232 deg C) maximum in 30 minutes of fire exposure.

1.05 DELIVERY, STORAGE, AND HANDLING

a. Deliver doors and frames cardboard-wrapped or crated to provide protection during transit and job storage. Provide additional protection to prevent damage to finish of factory-finished doors and frames.

b. Inspect doors and frames upon delivery for damage. Minor damages may be repaired provided refinished items are equal in all respects to new work and acceptable to Architect; otherwise, remove and replace damaged items as directed.

c. Store doors and frames at building site under cover. Place units on minimum 4-inches high wood blocking. Avoid use of non-vented plastic or canvas shelters which could create humidity chamber. If cardboard wrapper on door becomes wet, remove carton immediately. Provide 1/4-inches spaces between stacked doors to promote air circulation.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering standard steel doors and frames which may be incorporated in the work include; but are not limited to, the following:

1. Standard Steel Doors and Frames:

a. Amweld Building Products, Inc.
b. Ceco Corp.
c. Copco Door Co.
d. Curries Company.
e. Deansteel Manufacturing Co.
f. Fenestra Corp.
g. Kewanee Corp.
h. Mesker Door Co.

i. Pioneer Industries.
j. Premier Products, Inc. (Formerly Dittco).
k. Republic Builders Products.
l. Steelcraft Manufacturing Co.

2.02 MATERIALS

a. Hot-Rolled Steel Sheets and Strip: Commercial quality carbon steel, pickled and oiled, complying with ASTM A 569 and ASTM A 568.

b. Cold-Rolled Steel Sheets: Commercial quality carbon steel, complying with ASTM A 366 and ASTM A 568.

c. Galvanized Steel Sheets: Zinc-coated carbon steel sheets of commercial quality, complying with ASTM A 526, or drawing quality, ASTM A 642, hot dipped galvanized in accordance with ASTM A 525, with A60 or G60 coating designation, mill phosphatized.

e. Supports and Anchors: Fabricate of not less than 18-gage sheet steel; galvanized where used with galvanized frames.

f. Inserts, Bolts, and Fasteners: Manufacturer's standard units. Where items are to be built into exterior walls, hot-dip galvanize in compliance with ASTM A 153, Class C or D as applicable.

g. Shop Applied Paint: Apply after fabrication.

1. Primer: Rust-inhibitive enamel or paint, either air-drying or baking, suitable as a base for specified finish paints complying with ANSI A224.1, "Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames."

2.03 DOORS

a. Provide metal doors of SDI grades and models specified below or as indicated on drawings or schedules:

1. Interior Doors: ANSI/SDI-100, Grade III, extra heavy-duty, Model 4, minimum 16-gage galvanized steel faces. Continuous Hinges.

2.04 FRAMES

a. Provide metal frames for doors, transoms, sidelights, borrowed lights, and other openings, of types and styles as shown on drawings and schedules. Conceal fastenings, unless otherwise indicated. Fabricate frames of minimum 16-gage cold-rolled steel.

1. Fabricate frames with mitered or coped corners, welded construction
2. Form exterior frames from 16-gage galvanized steel.

b. Door Silencers: Except on weather-stripped frames, drill stops to receive 3 silencers on strike jambs of single-door frames and 2 silencers on heads of double-door frames.

2.05 FABRICATION

a. Fabricate steel door and frame units to be rigid, neat in appearance and free from defects,

warp or buckle. Wherever practicable, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory- assembled before shipment, to assure proper assembly at project site. Comply with ANSI/SDI-100 requirements.

1. Internal Construction: Manufacturer's standard honeycomb, polyurethane, polystyrene, unitized steel grid, vertical steel stiffeners, or rigid mineral fiber core with internal sound deadener on inside of face sheets where appropriate in accordance with SDI standards.
2. Clearances: Not more than 1/8 inch at jambs and heads except between non-fire-rated pairs of doors not more than 1/4 inch. Not more than 3/4 inch at bottom.

b. Fabricate exposed faces of doors and panels, including stiles and rails of non-flush units, from only cold-rolled steel.

c. Tolerances: Comply with SDI 117 "Manufacturing Tolerances Standard Steel Doors and Frames."

d. Fabricate frames, concealed stiffeners, reinforcement, edge channels, louvers and moldings from either cold-rolled or hot-rolled steel.

e. Fabricate exterior doors, panels, and frames from galvanized sheet steel in accordance with SDI-112. Close top and bottom edges of exterior doors as integral part of door construction or by addition of minimum 16-gage inverted steel channels.

f. Hardware Preparation: Prepare doors and frames to receive mortised and concealed hardware in accordance with final Door Hardware Schedule and templates provided by hardware supplier. Comply with applicable requirements of ANSI A115 Series Specifications for door and frame preparation for hardware.

g. Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied hardware may be done at project site.

h. Locate hardware as indicated on final shop drawings or, if not indicated, in accordance with "Recommended Locations for Builder's Hardware on Standard Steel Doors and Frames," published by Door and Hardware Institute.

i. Shop Painting: Clean, treat, and paint exposed surfaces of steel door and frame units, including galvanized surfaces.

1. Clean steel surfaces of mill scale, rust, oil, grease, dirt, and other foreign materials before application of paint.
2. Apply shop coat of prime paint of even consistency to provide a uniformly finished surface ready to receive finish paint.

j. Glazing Stops: Minimum 20 gage steel or .040-inch-thick aluminum.

1. Provide non-removable stops on outside of exterior doors and on secure side of interior doors for glass, louvers, and other panels in doors.
2. Provide screw applied removable glazing beads on inside of glass, louvers, and other panels in doors.

PART 3 - EXECUTION

3.01 INSTALLATION

a. General: Install standard steel doors, frames, and accessories in accordance with final shop drawings, manufacturer's data, and as herein specified.

b. Placing Frames: Comply with provisions of SDI-105 "Recommended Erection Instructions for Steel Frames," unless otherwise indicated.

1. Except for frames located at existing concrete, masonry or drywall installations, place frames prior to construction of enclosing walls and ceilings. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders leaving surfaces smooth and undamaged.
2. In masonry construction, locate 3 wall anchors per jamb adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Acceptable anchors include masonry wire anchors and masonry Tee anchors.
3. At existing concrete or masonry construction, provide 3 completed opening anchors per jamb adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb, set frames and secure to adjacent construction with bolts and masonry anchorage devices.
4. Install fire-rated frames in accordance with NFPA Standard No. 80.
5. In metal stud partitions, install at least 3 wall anchors per jamb at hinge and strike levels. In closed steel stud partitions, attach wall anchors to studs with screws.
6. In in-place drywall partitions install knock down slip-on drywall frames

c. Door Installation: Fit hollow metal doors accurately in frames, within clearances specified in ANSI/SDI-100.

1. Install fire-rated doors with clearances as specified in NFPA Standard No. 80.

3.02 ADJUST AND CLEAN

a. Prime Coat Touch-up: Immediately after erection, sand smooth any rusted or damaged areas of prime coat and apply touch-up of compatible air-drying primer.

b. Protection Removal: Immediately prior to final inspection, remove protective plastic wrappings from prefinished doors.

c. Final Adjustments: Check and readjust operating hardware items, leaving steel doors and frames undamaged and in complete and proper operating condition.

END OF SECTION 08 11 13.13

DIVISION 8: DOORS AND WINDOWS
Section 08 14 00: Flush Wood Doors

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions apply to work of this section.

1.2 SUMMARY:

A. Extent and location of each type of flush wood door is indicated on drawings and in schedules.

B. Types of doors required include the following:

1. Solid core flush wood doors with wood veneer faces.

1.3 SUBMITTALS:

A. Product Data: Door manufacturer's technical data for each type of door, including details of core and edge construction, trim for openings and louvers, and factory-finishing specifications.

B. Shop Drawings: Submit shop drawings indicating location and size of each door, elevation of each kind of door, details of construction, location and extent of hardware blocking, fire ratings, requirements for factory finishing and other pertinent data.

1.4 QUALITY ASSURANCE:

A. Quality Standards: Comply with the following standards:

1. NWWDA Quality Standard: I.S.1 "Industry Standard for Wood Flush Doors", of National Wood Window and Door Association (NWWDA).
2. AWI Quality Standard: "Architectural Woodwork Quality Standards"; including Section 1300 "Architectural Flush Doors", of Architectural Woodwork Institute (AWI) for grade of door, core construction, finish and other requirements exceeding those of NWWDA quality standard.

B. NWWMA Quality Marking: Mark each wood door with NWWDA Wood Flush Door Certification Hallmark certifying compliance with applicable requirements of NWWDA I.S. 1 Series.

1. For manufacturers not participating in NWWDA Hallmark Program, a certification of compliance may be substituted for marking of individual doors.

C. Fire-Rated Wood Doors: Provide wood doors which are identical in materials and construction to units tested in door and frame assemblies per ASTM E 152 and which are labeled and listed for ratings indicated by UL, Warnock Hersey or other testing and inspection agency acceptable to authorities having jurisdiction. Fire-Rated doors and frames shall have mechanically attached raised lettering/numerals on a metal label.

D. Manufacturer: Obtain doors from a single manufacturer.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING:

A. Protect doors during transit, storage and handling to prevent damage, soiling and deterioration. Comply with requirements of referenced standards and recommendations of NWWDA pamphlet "How to Store, Handle, Finish, Install, and Maintain Wood Doors", as well as with manufacturer's instructions.

B. Identify each door with individual opening numbers which correlate with designation system used on shop drawings for door, frames, and hardware, using temporary, removable or concealed markings.

1.6 PROJECT CONDITIONS:

A. Conditioning: Do not deliver or install doors until conditions for temperature and relative humidity have been stabilized and will be maintained in storage and installation areas during remainder of construction period to comply with the following requirements applicable to project's geographical location:

1. Referenced AWI quality standard including Section 100-S-3 "Moisture Content".

1.7 WARRANTY:

A. General: Warranties shall be in addition to, and not a limitation of, other rights the Owner may have under the Contract Documents.

B. Door Manufacturer's Warranty: Submit written agreement in door manufacturer's standard form signed by Manufacturer, Installer and Contractor, agreeing to repair or replace defective doors that have warped (bow, cup or twist) or that show telegraphing of core construction in face veneers, or do not conform to tolerance limitations of referenced quality standards.

1. Warranty shall also include reinstallation which may be required due to repair or replacement of defective doors where defect was not apparent prior to hanging.
2. Warranty shall be in effect during following period of time after date of Substantial Completion.
3. Solid Core Interior Doors:

a. Five years.

C. Contractor's Responsibilities: Replace or refinish doors where Contractor's work contributed to rejection or to voiding of manufacturer's warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering doors which may be incorporated in the work include, but are not limited to, the following:

1. Solid Core Doors with Wood Veneer Faces:

a. Algoma Hardwoods, Inc.
b. Buell Door Company.
c. Cal-Wood Door Div., Timberland Industries, Inc.
d. Chappell Door Company.

e. Doors, Incorporated.
f. Eggers Industries, Architectural Door Division.
g. Gay Doors, Inc.
h. Glen-Mar Door Mfg. Co.
i. Graham Manufacturing Corp.
j. Ipik Door Co., Inc.
k. Mohawk Flush Doors, Inc.
l. Weyerhauser Company.
m. Escon Doors

2.2 INTERIOR FLUSH WOOD DOORS:

A. Solid Core Doors for Opaque Finish: Comply with the following requirements:

1. Faces: Natural birch hardwood face veneers.
2. AWI Grade: Premium.
3. Construction: PC-5 (Particleboard core, 5-ply).

B. Fire-Rated Solid Core Doors: Comply with the following requirements.

C. Faces and AWI Grade: Provide faces and grade to match non-rated doors in same area of building, unless otherwise indicated.

1. Construction: Manufacturer's standard core construction as required to provide fire-resistance rating indicated.
2. Edge Construction: Provide manufacturer's standard laminated edge construction for improved screw-holding capability and split resistance as compared to edges composed of a single layer of treated lumber.
3. Faces: Natural birch, rotary cut.
4. AWI Grade: Premium.

2.3 FABRICATION:

A. Fabricate flush wood doors to produce doors complying with following requirements:

1. In sizes indicated for job-site fitting.

PART 3 - EXECUTION

3.1 EXAMINATION:

A. Examine installed door frames prior to hanging door:

1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with plumb jambs and level heads.
2. Reject doors with defects.

B. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION:

A. Hardware: Provide hardware as specified in Section 08 71 00.

B. Manufacturer's Instructions: Install wood doors to comply with manufacturer's instructions and of referenced AWI standard and as indicated.

1. Install fire-rated doors in corresponding fire-rated frames in accordance with requirements of NFPA No. 80.

C. Job-Fit Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted with fire-rated doors. Machine doors for hardware. Seal cut surfaces after fitting and machining.

1. Fitting Clearances for Non-Rated Doors: Provide 1/8" at jambs and heads; 1/16" per leaf at meeting stiles for pairs of doors; and 1/8" from bottom of door to top of decorative floor finish or covering. Where threshold is shown or scheduled, provide 1/4" clearance from bottom of door to top of threshold.
2. Fitting Clearances for Fire-Rated Doors: Complying with NFPA 80.
3. Bevel non-rated doors 1/8" in 2" at lock and hinge edges.
4. Bevel fire-rated doors 1/8" in 2" at lock edge; trim stiles and rails only to extent permitted by labeling agency.

D. Field-Finished Doors: Refer to the following for finishing requirements:

1. Stain doors in color selected by Architect.

3.3 ADJUSTING AND PROTECTION:

A. Operation: Rehang or replace doors which do not swing or operate freely.

B. Finished Doors: Refinish or replace doors damaged during installation.

C. Protect doors as recommended by door manufacturer to ensure that wood doors will be without damage or deterioration at time of Substantial Completion.

END OF SECTION 08 14 00

DIVISION 8: DOORS AND WINDOWS
Section 08 14 00: Interior Doors

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions apply to work of this section.

1.2 SUMMARY:

A. Extent and location of each type of flush wood door is indicated on drawings and in schedules.

B. Types of doors required include the following:

1. PreHung swinging Pre Hung 5 panel MDF interior doors.
2. Sliding MDF 5 panel interior doors and sliding operational barn door hardware.

1.3 SUBMITTALS:

A. Product Data: Door manufacturer's technical data for each type of door, including details of core and edge construction, trim for openings and louvers, and finishing specifications.

B. Shop Drawings: Submit shop drawings indicating location and size of each door, elevation of each kind of door, details of construction, location and extent of hardware blocking, fire ratings, requirements for factory finishing and other pertinent data.

1.4 QUALITY ASSURANCE:

A. Quality Standards: Comply with the following standards:

1. AWI Quality Standard: "Architectural Woodwork Quality Standards"; including Section 1300 "Architectural Flush Doors", of Architectural Woodwork Institute (AWI) for grade of door, core construction, finish and other requirements exceeding those of NWWDA quality standard.

B. Manufacturer: Obtain doors from a single manufacturer. Basis of Design , Glass Craft Door Company or prior approved equivalent.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING:

A. Protect doors during transit, storage and handling to prevent damage, soiling and deterioration. Comply with requirements of referenced standards and recommendations of NWWDA pamphlet "How to Store, Handle, Finish, Install, and Maintain Wood Doors", as well as with manufacturer's instructions.

B. Identify each door with individual opening numbers which correlate with designation system used on shop drawings for door, frames, and hardware, using temporary, removable or concealed markings.

1.6 PROJECT CONDITIONS:

A. Conditioning: Do not deliver or install doors until conditions for temperature and relative humidity have been stabilized and will be maintained in storage and installation areas during remainder of construction period to comply with the following requirements applicable to project's geographical location:

1. Referenced AWI quality standard including Section 100-S-3 "Moisture Content".

1.7 WARRANTY:

A. General: Warranties shall be in addition to, and not a limitation of, other rights the Owner may have under the Contract Documents.

B. Door Manufacturer's Warranty: Submit written agreement in door manufacturer's standard form signed by Manufacturer, Installer and Contractor, agreeing to repair or replace defective doors that have warped (bow, cup or twist) or that show telegraphing of core construction in face veneers, or do not conform to tolerance limitations of referenced quality standards.

1. Warranty shall also include reinstallation which may be required due to repair or replacement of defective doors where defect was not apparent prior to hanging.
2. Warranty shall be in effect during following period of time after date of Substantial Completion.
3. Interior Doors:

a. Five years.

C. Contractor's Responsibilities: Replace or refinish doors where Contractor's work contributed to rejection or to voiding of manufacturer's warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering doors which may be incorporated in the work include, but are not limited to, the following:

1. Swinging and Sliding Interior MDF Doors

a. Glass Craft Door Company , Trimlite, or prior approved equivalent

2.2 INTERIOR SWINGING PRE-HUNG 5 PANEL MDF DOORS:

A. Trimlite Shaker 5 Panel Interior Pre Hung Passage door with Satin Nickel Hinges. Factory Primed finish.

2.25 INTERIOR SLIDING MDF 5 PANEL DOORS AND SLIDING OPERATIONAL BARN DOOR HARDWARE

A. BarnCraft MDF Door Series. Factory primed MDF 5 panel Doors with stile width of 5”. Vista Stainless Steel HP45 recessed pulls both sides. Wall mounted floor guide. Soft Close Attachment.

B. BarnCraft Sliding Door Hardware. Gage Stainless Steel #BDHA02SS, Rail ¼” thick Stainless Steel #BDHHA02SSK. Privacy Hook and Eye Gate Latch Lock for Sliding Barn Door, Satin Brushed Nickel 4” by Raswick or equivalent.

2.3 FABRICATION:

A. Fabricate doors to produce doors complying with following requirements:

1. In sizes indicated for job-site fitting.

PART 3 - EXECUTION

3.1 EXAMINATION:

A. Examine installed door frames prior to hanging door:

1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with plumb jambs and level heads.
2. Reject doors with defects.

B. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION:

A. Hardware: Provide hardware as specified in Section 08 71 00.

B. Manufacturer's Instructions: Install doors to comply with manufacturer's instructions and of referenced AWI standard and as indicated.

1. Install fire-rated doors in corresponding fire-rated frames in accordance with requirements of NFPA No. 80.

C. Job-Fit Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted with fire-rated doors. Machine doors for hardware. Seal cut surfaces after fitting and machining.

1. Fitting Clearances for Non-Rated Doors: Provide 1/8" at jambs and heads; 1/16" per leaf at meeting stiles for pairs of doors; and 1/8" from bottom of door to top of decorative floor finish or covering. Where threshold is shown or scheduled, provide 1/4" clearance from bottom of door to top of threshold.
2. Fitting Clearances for Fire-Rated Doors: Complying with NFPA 80.
3. Bevel non-rated doors 1/8" in 2" at lock and hinge edges.
4. Bevel fire-rated doors 1/8" in 2" at lock edge; trim stiles and rails only to extent permitted by labeling agency.

D. Field-Finished Doors: Refer to the following for finishing requirements:

1. Paint doors in color selected by Architect.

3.3 ADJUSTING AND PROTECTION:

A. Operation: Rehang or replace doors which do not swing, slide or operate freely.

B. Finished Doors: Refinish or replace doors damaged during installation.

C. Protect doors as recommended by door manufacturer to ensure that doors will be without damage or deterioration until Owner's Final Acceptance.

END OF SECTION 08 14 00

DIVISION 8: DOORS AND WINDOWS
Section 08 56 00: Vinyl Windows

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Vinyl single hung and fixed window complete with hardware, glazing, weather strip, insect screen and half screen, and standard or specified anchors, trim and attachments.

1.2 RELATED SECTIONS

A. Section 01 33 00—Submittal Procedures: Shop Drawings, Product Data, and Samples.
B. Section 01 60 00—Product Options
C. Section 09 91 00—Paints and Coatings: Paint or stain other than factory applied finish

1.3 SYSTEM DESCRIPTION

A. Design and Performance Requirements:
   1. Window units shall be designed to comply with AAMA/NWWDA 101/I.S.2-97
      a. Single Hung or Fixed (As Indicated on Drawings / Window Schedule)
      b. Units must be Energy Star compliant with a .35 or better U-factor and .30 or better Solar Heat Gain Coefficient
      c. Top glass must be able to be re-glazed in the field without the requirement of special tools

1.4 SUBMITTALS

A. Shop Drawings: Submit shop drawings under provisions of Section 01 33 23.
B. Product Data: Submit catalog data under provisions of Section 01 33 23.
C. Samples:
   1. Submit corner section under provisions of Section 01 33 23.
   2. Include glazing system, quality of construction, and specified finish.

D. Quality Control Submittals: Submit manufacturer's certifications indicating compliance with specified performance and design requirements under provisions of Section 01 33 23.

1.5 QUALITY ASSURANCE

A. Code Requirements: Consult local code for IBC [International Building Code] and IRC [International Residential Code] adoption year and pertinent revisions for information on:
   1. Egress, emergency escape, and rescue requirements
   2. Tempered glass requirements
   3. Basement window requirements
   4. Window fall prevention and window opening control device requirements

1.6 DELIVERY

A. Comply with provisions of Section 01 65 00.
B. Deliver in original packaging and protect from weather.

1.7 STORAGE AND HANDLING

A. Prime or seal wood surfaces, including surface to be concealed by wall construction, if more than thirty (30) days will expire between delivery and installation.

B. Store window units in an upright position in a clean and dry storage area above ground and protect from weather under provisions of Section 01 66 00.

1.8 WARRANTY

A. Windows shall be warranted to be free from defects in manufacturing, materials, and workmanship for a period of ten
(20) years from purchase date.
B. Window glass shall be warranted to be free from defects in manufacturing, materials and workmanship for period of twenty (20) years from the purchase date.
C. Window locks, keepers, latches, lifts, weather stripping, balances and screen frames shall be warranted to be free from defects in manufacturing, materials and workmanship for a period of one (1) year from purchase date.

PART 2 PRODUCTS

2.1 MANUFACTURED UNITS

A. Description: Southern Rose Series 6010 Single Hung Window, Series 4710 Fixed Window as manufactured by MGM Industries, Hendersonville, Tennessee. (BASIS OF DESIGN OR PRIOR APPROVED EQUIVALENT)

2.2 FRAME DESCRIPTION

A. Main frame shall be a multi-chambered design constructed of extruded, high impact resistant and UV stabilized, rigid polyvinyl chloride (PVC) and shall incorporate an integral brick-mold w/optional J-Channel siding pocket
B. Typical wall for extruded frame shall be .062” or as indicated on the individual extrusion die drawings
C. Brick mold shall be a two wall cavity (full 180) design with a minimum 2 ¼” exterior face
D. J-Channel pocket shall be no less than ¾” x ¾”
E. Main frame head and jamb shall have a 1 ¼” pre-punched nail fin
F. Jamb to sill shall be processed and mechanically fastened to a 5 degree slope sill
G. All screws and fastening devices shall be coated with Zinc or Cadmium in conformance with ASTM B 633-85 (1994) and / or ASTM B 766-86 (1993)
H. Removable center meeting rail shall be available for dry wall pass thru if needed
I. Twins and Triple units shall have a continuous Head and Sill with integral mullion, mechanically fastened to head and sill.
J. Frame width: 2 15/16” inches
K. Jamb depth: 1 13/16” inches

2.3 SASH DESCRIPTION

A. Sash components shall be a multi-chambered design constructed of extruded, high impact resistant and UV stabilized, rigid polyvinyl chloride (PVC)
B. Typical wall for extruded frame shall be .062” or as indicated on the individual extrusion die drawings
C. All screws and fastening devices shall be coated with Zinc or Cadmium in conformance with ASTM B 633-85 (1994) and / or ASTM B 766-86 (1993)
D. Composite sash thickness: 1 5/8” inches
E. Equal sash Style.
F. Bottom Operating Sash tilt to interior for cleaning or removal.

2.4 GLAZING

A. Top glass is interior wet glazed into the main frame. Vent is tilt type, chop, processed and mechanically fastened
B. Glass shall be overall ¾" thick sealed insulating unit, using warm edge spacer technology
C. Glass type: Low E 270 w/argon

2.5 FINISH

A. Exterior: All window members shall have be integral white.
B. Interior: All window members shall have be integral white.

2.6 HARDWARE

A. Balance System: Coil spring block and tackle with nylon cord, glass filled nylon shoe and zinc locking mechanism.
B. Sash Lock: High pressure zinc die-cast cam lock and keeper.
    1. Finish: Color match to interior
    2. Two locks on units
C. Bottom Tilt Latches: Ergonomic tilt latches attached to the upper corners of the bottom sash for easy tilting and sash removal.
D. Vent Stops: Available as a factory option. Injected molded nylon, stone white in color. Vent stops limits the sash operation when activated and allow normal operation when deactivated.

2.7 WEATHER STRIP

A. Frame Weather strip
    1. All window gaps between main frame and sash members shall be weather-stripped to prevent air infiltration.
    2. Weather-strip shall be a poly pile type with an integral polyethylene fin and shall conform to AAMA 701-92 and 702-92

2.8 INSECT SCREEN

A. Factory installed half screen.

    1. Screen mesh, 18 by 16: Charcoal fiberglass.
    2. Screen frame, 5/16" x 3/4" roll formed aluminum, color matched to exterior finish of window
    3. Screens shall conform to ANSI/AAMA 1004-1987

2.9 GRILLES-BETWEEN-THE-GLASS (GBG)

A. Manufactured from aluminum in an 3/4" wide flat profile placed between the two panes of glass.
    1. Rectangular pattern per plan
B. Colors: Grilles to match exterior/interior finish of window.

2.10 ACCESSORIES AND TRIM

A. Jamb Extensions
    1. Factory applied 4 9/16" or 6 9/16" available
    2. Jamb extensions to be finished on site

2.11 WINDOW SCHEDULE
    A. 3'-0" X 4'-8"
    B. 2'-0" X 3'-0"

C. 2’-8” X 3’-0”
D. 5’-2” X 4’-8”
E. 1’-10 ½” X 6’-0”
F. 2’-6 ¼” X 6’-0” , 2’-6 ¼” x 6’-0” Twin Unit
G. 1’-10 ½” X 1’-4” , 2’-8”X1’-4” Twin Unit Clerestory Height
H. 2’-6 ¼” x 1’-4”, 2’-6 ¼”x 1’-4” Twin Unite Clerestory Height
J. 2’-8” x 6’-0”

PART 3 EXECUTION

3.1 EXAMINATION

A. Verification of Conditions: Before Installation, verify openings are plumb, square, and of proper dimension. Report frame defects or unsuitable conditions to the General Contractor before proceeding.
B. Acceptance of Conditions: Beginning of installation confirms acceptance of existing conditions.

3.2 INSTALLATION

A. Comply with Section 01 73 00.
B. Assemble and install window unit according to manufacturer’s instructions and reviewed shop drawings.

C. Install sealant and related backing materials at perimeter of unit or assembly in accordance with Section 07901 Joint Sealants. Do not use expansive foam sealant.
D. Install accessory items as required.
E. Use finish nails to apply wood trim and moldings.

3.3 CLEANING

A. Remove visible labels and adhesive residue according to manufacturer's instructions.
B. Leave windows and glass in a clean condition. Final cleaning as required.

3.4 PROTECTING INSTALLED CONSTRUCTION

A. Protect windows from damage by chemicals, solvents, paint, or other construction operations that may cause damage.

END OF SECTION

DIVISION 8:

Section 08 71 00: Door Hardware

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes items known commercially as finish or door hardware that are required for swing, sliding, and folding doors, except special types of unique hardware specified in the same sections as the doors and door frames on which they are installed.

B. This Section includes the following:

1. Lock and latch sets.
2. Dead Bolts.

C. Related Sections: The following Sections contain requirements that relate to this Section:

1. 08 10 00 Fiberglass Entry Doors
2. 08 14 00 Interior Wood Doors
3. 08 11 13.13 Standard Hollow Metal Doors and Frames

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification sections.

B. Product data including manufacturers' technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.

C. Final hardware schedule coordinated with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Final Hardware Schedule Content: Based on hardware indicated, organize schedule into "hardware sets" indicating complete designations of every item required for each door or opening. Include the following information:

a. Type, style, function, size, and finish of each hardware item.
b. Name and manufacturer of each item.
c. Fastenings and other pertinent information.
d. Location of each hardware set cross referenced to indications on Drawings both on floor plans and in door and frame schedule.

e. Explanation of all abbreviations, symbols, and codes contained in schedule.
f. Mounting locations for hardware.
g. Door and frame sizes and materials.
h. Keying information.

2. Submittal Sequence: Submit final schedule at earliest possible date particularly where acceptance of hardware schedule must precede fabrication of other work that is critical in the Project construction schedule. Include with schedule the product data, samples, shop drawings of other work affected by door hardware, and other information essential to the coordinated review of schedule.
3. Submittal Sequence: Submit initial draft of final schedule along with essential product data in order to facilitate the fabrication of other work that is critical in the Project construction schedule. Submit final schedule after samples, product data, coordination with shop drawings of other work, delivery schedules, and similar information has been completed and accepted.
4. Keying Schedule: Submit separate detailed schedule indicating clearly how the Owner's final instructions on keying of locks has been fulfilled.

D. Samples of each type of exposed hardware unit in finish indicated and tagged with full description for coordination with schedule. Submit samples prior to submission of final hardware schedule.

1. Samples will be returned to the supplier. Units that are acceptable and remain undamaged through submittal, review, and field comparison process may, after final check of operation, be incorporated in the Work, within limitations of keying coordination requirements.

E. Templates for doors, frames, and other work specified to be factory prepared for the installation of door hardware. Check shop drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

1.4 QUALITY ASSURANCE

A. Single Source Responsibility: Obtain each type of hardware (latch and lock sets, hinges, closers, etc.) from a single manufacturer.

1.5 PRODUCT HANDLING

A. Tag each item or package separately with identification related to final hardware schedule, and include basic installation instructions with each item or package.

B. Packaging of door hardware is responsibility of supplier. As material is received by hardware supplier from various manufacturers, sort and repackage in containers clearly marked with appropriate hardware set number to match set numbers of approved hardware schedule. Two or more identical sets may be packed in same container.

C. Inventory door hardware jointly with representatives of hardware supplier and hardware installer until each is satisfied that count is correct.

D. Deliver individually packaged door hardware items promptly to place of installation (shop or Project site).

E. Provide secure lock-up for door hardware delivered to the Project, but not yet installed. Control handling and installation of hardware items that are not immediately replaceable so that completion of the Work will not be delayed by hardware losses both before and after installation.

1.6 MAINTENANCE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following. Requests for substitutions shall be submitted in writing to the architect 10 days prior to the project bid date.

1. Continuous Gear Hinges:

a. Ives
b. Select Products
c. Bommer

2. Locks & Latches:

a. Schlage Sacremento Lever by Schlage.

4. Door Stops, Kick, Mop, and Armor Plates:

a. Ives
b. Hiawatha
c. Trimco

5. Thresholds:

a. Zero
b. National Guard Products, Inc.
c. Pemko

6. Weather Stripping:

a. Zero
b. National Guard Products, Inc.
c Pemko

2.2 SCHEDULED HARDWARE

A. Requirements for design, grade, function, size, and other distinctive qualities of each type of finish hardware are indicated in the "Hardware Schedule" at the end of this Section. Products are identified by using hardware designation numbers of the following:

1. Manufacturer's Product Designations: The product designation and name of one manufacturer are listed for each hardware type required for the purpose of establishing minimum requirements. Provide either the product designated or, where more than one manufacturer is specified under the Article "Manufacturers" in Part 2 for each hardware type, the comparable product of one of the other manufacturers that complies with requirements.
2. ANSI/BHMA designations used elsewhere in this Section or in schedules to describe hardware items or to define quality or function are derived from the following standards. Provide products complying with these standards and requirements specified elsewhere in this Section.

a. Material and Finishes: ANSI/BHMA A156.18.

2.3 MATERIAL AND FABRICATION

A. Base Metals: Produce hardware units of basic metal and forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness, but in no case of lesser (commercially recognized) quality than specified for applicable hardware units by applicable ANSI/BHMA A156 series standards for each type of hardware item and with ANSI/BHMA A156.18 for finish designations indicated. Do not furnish "optional" materials or forming methods for those indicated, except as otherwise specified.

B. Base Metals: Produce hardware units of basic metal and forming method indicated using manufacturer's standard metal alloy, composition, temper, and hardness, but in no case of lesser (commercially recognized) quality than specified for applicable hardware units for finish designations indicated.

C. Furnish screws for installation with each hardware item. Provide Phillips flat-head screws except as otherwise indicated. Finish exposed (exposed under any condition) screws to match hardware finish or, if exposed in surfaces of other work, to match finish of this other work as closely as possible including "prepared for paint" surfaces to receive painted finish.

2.4 HINGES, BUTTS, AND PIVOTS

A. Templates: New door frames: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units. Unless specified otherwise in the hardware sets, hinge size shall typically be 4 ½” x 4 ½”.

B. Screws: Provide Phillips flat-head screws complying with the following requirements:

1. For metal doors and frames install machine screws into drilled and tapped holes.
2. For wood doors and frames install wood screws.
3. For fire-rated wood doors install #12 x 1-1/4-inch, threaded-to-the-head steel wood screws.
4. Finish screw heads to match surface of hinges or pivots.

C. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:

1. Out-Swing Exterior Doors: Non-removable pins.
2. Out-Swing Corridor Doors with Locks: Non-removable pins.

3. Interior Doors: Standard pre hung door units.

4. Tips: Flat button and matching plug, finished to match leaves, except where hospital tip (HT) indicated.

D. Number of Hinges: Provide number of hinges indicated but not less than 3 hinges per door leaf for doors 90 inches or less in height and one additional hinge for each 30 inches of additional height.

1. Fire-Rated Doors: Not less than 3 hinges per door leaf for doors 86 inches or less in height with same rule for additional hinges.

2.4 LOCKS, LATCHES, AND BOLTS

A. Strikes: New door frames: Provide manufacturer's standard wrought box strike for each latch or lock bolt, with curved lip extended to protect frame, finished to match hardware set, unless otherwise indicated.

1. Provide flat lip strikes for locks with antifriction latch bolts as recommended by manufacturer.
2. Provide extra long strike lips for locks used on frames with applied wood casing trim.
3. Provide recess type top strikes for bolts locking into head frames, unless otherwise indicated.
4. Provide dust-proof strikes for foot bolts, except where special threshold construction provides non-recessed strike for bolt.
5. Provide roller type strikes where recommended by manufacturer of the latch and lock units.
6. Provide standard (open) strike plates for interior doors of residential units where wood door frames are used.

B. Lock Throw: Provide 5/8-inch minimum throw of latch on pairs of doors. Comply with UL requirements for throw of bolts and latch bolts on rated fire openings.

1. Provide 1/2-inch minimum throw of latch for other bored and preassembled types of locks and 3/4-inch minimum throw of latch for mortise locks. Provide 1-inch minimum throw for all dead bolts.

2.5 WEATHERSTRIPPING AND SEALS

A. General: Provide continuous weather stripping on exterior doors and smoke, light, or sound seals on interior doors where indicated or scheduled. Provide non-corrosive fasteners for exterior applications and elsewhere as indicated. Provide types specified in hardware sets.

2.6 THRESHOLDS

A. General: Except as otherwise indicated, provide standard metal threshold unit of type, size, and profile as shown or scheduled in the hardware sets.

2.7 HARDWARE FINISHES

A. The designations used to indicate hardware finishes are those listed in ANSI/BHMA A156.18, "Materials and Finishes," including coordination with the traditional U.S. finishes shown by certain manufacturers for their products. **Unless specified otherwise in the door hardware sets**, provide door hardware materials in the finishes specified below:

Butt Hinges:	Satin Nickel.
Locks and Latches	Satin Nickel.
Wall Stops	Satin Nickel
Thresholds	Aluminum

PART 3 - EXECUTION

3.1 INSTALLATION

A. Mount hardware units at heights indicated in following applicable publications, except as specifically indicated or required to comply with governing regulations and except as otherwise directed by Architect.

1. "Recommended Locations for Builders Hardware for Standard Steel Doors and Frames" by the Door and Hardware Institute.
2. NWWDA Industry Standard I.S.1.7, "Hardware Locations for Wood Flush Doors."

B. Install each hardware item in compliance with the manufacturer's instructions and recommendations. Where cutting and fitting is required to install hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation or application of surface protection with finishing work specified in the Division 9 Sections. Do not install surface-mounted items until finishes have been completed on the substrates involved.

C. Set units level, plumb, and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.

D. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

E. Set threshold for exterior doors in full bed of butyl-rubber or polyisobutylene mastic sealant complying with requirements specified in Division 7 Section "Joint Sealers."

F. Weather stripping and Seals: Comply with manufacturer's instructions and recommendations to the extent installation requirements are not otherwise indicated.

3.2 ADJUSTING, CLEANING, AND DEMONSTRATING

A. Adjust and check each operating item of hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate freely and smoothly or as intended for the application made.

1. Where door hardware is installed more than one month prior to acceptance or occupancy of a space or area, return to the installation during the week prior to acceptance or occupancy and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.

B. Clean adjacent surfaces soiled by hardware installation.

3.3 HARDWARE SCHEDULE 08 17 00

A. General: Provide hardware for each door to comply with requirements of Section 08 71 00 - "Door Hardware," and in the following schedule of hardware sets. Door numbers are posted with in the hardware sets indicating their assignment to this set.

1. Hardware sets indicate quantity, item, manufacturer and product designation, size, and finish or color, as applicable. Provide hardware for all doors shown on drawing floor plans whether specified in the door hardware sets or not.

HARDWARE SET: **HW-1**

Schlage Sacramento keyed entry – F51 SAC 619, Satin Nickel

Single Cylinder Dead Bolt – B60 619, Satin Nickel

Door Mounted Satin Nickel Spring Type Door Stop so as to engage wood base.

HARDWARE SET: **HW-2**

Schlage CO-Series Commercial Electronic Cylindrical Lock with Proximity and Sparta Lever – CO200CY70PRSPA619, Satin Nickel

Schlage One Sided Deadbolt, B80 619, Satin Nickel, Deadbolt is thrown or retracted from interior only. NO Exterior plate or exposed trim.

Door Mounted Satin Nickel Spring Type Door Stop so as to engage wood base.

HARDWARE SET: **HW-3**

Schlage Sacramento Lever Hall and Closet – F10 SAC 619, Satin Nickel

Door Mounted Satin Nickel Spring Type Door Stop so as to engage wood base.

HARDWARE SET: **HW-4**

Schlage Sacramento Lever Bed & Bath Lock – F40 SAC 619, Satin Nickel

Door Mounted Satin Nickel Spring Type Door Stop so as to engage wood base.

HARDWARE SET: **HW-5**

Schlage Sacramento Keyed Entry – F51 SAC 619, Satin Nickel

Single Cylinder Dead Bolt – B60-619, Satin Nickel

Continuous Gear Hinge – Ives by Allegion, HD Series, Full Mortise, Clear Anodized Finish (628)

Door Mounted Satin Nickel Spring Type Door Stop so as to engage wood base.

2. At door 1A adjacent to refrigerator provide floor mounted brushed nickel door stop so as to prevent door swing into refrigerator.

END OF SECTION

DIVISION 08 00 00: OPENINGS
Section 08 81 00: Glazing

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions apply to work of this section.

1.2 DELIVERY, STORAGE AND HANDLING

A. Protect glass and glazing materials during delivery, storage and handling to comply with manufacturer's directions and as required to prevent edge damage to glass, and damage to glass and glazing materials from effects of moisture including condensation, of temperature changes, of direct exposure to sun, and from other causes.

1.3 PROJECT CONDITIONS

A. Environmental Conditions: Do not proceed with glazing when ambient and substrate temperature conditions are outside the limits permitted by glazing material manufacturer or when joint substrates are wet due to rain, frost, condensation or other causes.

1. Install liquid sealants at ambient and substrate temperatures above 40 deg. F (4.4 deg. C).

1.4 SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

PART 2 - PRODUCTS

2.1 GLASS PRODUCTS, GENERAL

A. Primary Glass Standard: Provide primary glass which complies with ASTM C 1036 requirements, including those indicated by reference to type, class, quality, and, if applicable, form, finish, mesh and pattern.

B. Heat-Treated Glass Standard: Provide heat-treated glass which complies with ASTM C1048 requirements, including those indicated by reference to kind, condition, type, quality, class, and if applicable, form, finish and pattern.

C. Sizes: Fabricate glass to sizes required for glazing openings indicated, with edge clearances and tolerances complying with recommendations of glass manufacturer. Provide thicknesses indicated or, of not otherwise indicated, as recommended by glass manufacturer for application indicated.

2.2 GLASS PRODUCTS, SPECIFIC

A. Safety glazing shall be 1/8", 1/4" or 3/8" tempered clear where indicated. See Door, H.M. and Glazing Schedules.

B. Insulated glazing as indicated on the Glazing Schedule shall be 1” insulated and shall be as specified in Section 08 52 00 for the aluminum windows as well as the aluminum storefront.

C. Glazing tapes and sealants shall be as recommended by glass manufacturers.

D. Framed Vanity Mirrors: Basis of Design or prior approved equivalent.
5. Miseno Americana 30” x 24” Rectangular Framed Mirro Model MM-AMER24
7. Miseno Femmina 60” x 30” Rectangular Framed Mirror. Model MM-FEM60

2.3 PRIMARY GLASS PRODUCTS

A. Clear Float Glass: Type I (transparent glass, flat), Class 1 (clear), Quality q3 (glazing select).

B. Polished Wire Glass: Form 1 (wired, polished both sides), Mesh m1 (diamond).

2.4 HEAT-TREATED GLASS PRODUCTS

A. Coated Tinted Heat Treated Float Glass: Condition C (other coated glass), Type I (transparent glass, flat), Class 2 (tinted heat absorbing and light reducing), Quality q3 (glazing select), with coating type and performance characteristics complying with requirements specified under coated glass products; kind as indicated below:

1. Kind FT (fully tempered) where required.

2.5 GLAZING GASKETS

A. Lock-Strip Gaskets: Neoprene extrusions of size and shape indicated, fabricated into frames with molded corner units and zipper lock strips, complying with ASTM C542; black.

B. Dense Elastomeric Compression Seal Gaskets: Molded or extruded gaskets of material indicated below, complying with ASTM C 864, of profile and hardness required to maintain watertight seal:

1. EPDM.

C. Cellular Elastomeric Preformed Gaskets: Extruded or molded closed cell, integral-skinned neoprene of profile and hardness required to maintain watertight seal; complying with ASTM C509, Type II; black.

2.6 MISCELLANEOUS GLAZING MATERIALS

A. Compatibility: Provide materials with proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers and Sealers: Type recommended by sealant or gasket manufacturer.

C. Setting Blocks: Neoprene, EPDM or silicone blocks as required for compatibility with glazing

sealants, 80 to 90 Shore A durometer hardness.

D. Spacers: Neoprene, EPDM or silicone blocks, or continuous extrusions, as required for compatibility with glazing sealant, of size, shape and hardness recommended by glass and sealant manufacturers for application indicated.

E. Edge Blocks: Neoprene, EPDM or silicone blocks as required for compatibility with glazing sealant, of size and hardness required to limit lateral movement (side-walking) of glass.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Require Glazier to inspect work of glass framing erector for compliance with manufacturing and installation tolerances, including those for size, squareness, offsets at corners; for presence and functioning of weep system; for existence of minimum required face or edge clearances; and for effective sealing of joinery. Obtain Glazier's written report listing conditions detrimental to performance of glazing work. Do not allow glazing work to proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members to receive glass, immediately before glazing. Remove coatings which are not firmly bonded to substrates. Remove lacquer from metal surfaces where elastomeric sealants are indicated for use.

3.3 GLAZING, GENERAL

A. Comply with combined printed recommendations of glass manufacturers, of manufacturers of sealants, gaskets and other glazing materials, except where more stringent requirements are indicated, including those of referenced glazing standards.

B. Glazing channel dimensions are required to provide for necessary bite on glass, minimum edge and face clearances, and adequate sealant thickness, with reasonable tolerances. Adjust as required by job conditions at time of installation.

C. Protect glass from edge damage during handling and installation; use a rolling block in rotating glass units to prevent damage to glass corners. Do not impact glass with metal framing. Use suction cups to shift glass units within openings; do not raise or drift glass with a pry bar. Rotate glass with flares or bevels along one horizontal edge which would occur in vicinity of setting blocks so that these are located at top of opening. Remove from project and dispose of glass units with edge damage or other imperfections of kind that, when installed, weakens glass and impairs performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

3.3 GLAZING

A. Install setting blocks of proper size in sill rabbet, located one quarter of glass width from each corner, but with edge nearest corner not closer than 6" from corner unless otherwise required. Set blocks in thin course of sealant which is acceptable for heel bead use.

B. Provide spacers inside and out, of correct size and spacing to preserve required face clearances, for glass sizes larger than 50 united inches (length plus height), except where gaskets or glazing tapes with continuous spacer rods are used for glazing. Provide _" minimum bite of spacers on glass and use thickness equal to sealant width, except with sealant tape use thickness slightly less than final compressed thickness of tape.

C. Provide edge blocking to comply with requirements of referenced glazing standard, except where otherwise required by glass unit manufacturer.

D. Set units of glass in each series with uniformity of pattern, draw, bow and similar characteristics.

E. Provide compressible filler rods or equivalent back-up material, as recommended by sealant and glass manufacturers, to prevent sealant from extruding into glass channel weep systems and from adhering to joints back surface as well as to control depth of sealant for optimum performance, unless otherwise indicated.

F. Force sealants into glazing channels to eliminate voids and to ensure complete "wetting" or bond of sealant to glass and channel surfaces.

G. Tool exposed surfaces of sealants to provide a substantial "wash" away from glass. Install pressurized tapes and gaskets to protrude slightly out of channel, so as to eliminate dirt and moisture pockets.

H. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage to ensure that gasket will not "walk" out when installation is subjected to movement.

I. Miter cut wedge-shaped gaskets at corners and install gaskets in manner recommended by gasket manufacturer to prevent pull away at corners; seal corner joints and butt joints with sealant recommended by gaskets manufacturer.

3.4 PROTECTING AND CLEANING

A. Protect exterior glass from breakage immediately upon installation by use of crossed streamers attached to framing and held away from glass. Do not apply markers to surfaces of glass. Remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove immediately by method recommended by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less often than once a month, for build-up of dirt, scum, alkali deposits or staining. When examination reveals presence of these forms of residue, remove by method recommended by glass manufacturer.

D. Remove and replace glass which is broken, chipped, cracked, abraded or damaged in other ways during construction period, including natural causes, accidents and vandalism.

E. Wash glass on both faces not more than 4 days prior to date scheduled for inspections intended to establish date of substantial completion in each area of project. Wash glass by

method recommended by glass manufacturer.

END OF SECTION 08 81 00

DIVISION 08 00 00: OPENINGS
Section 08 91 00: Louvers and Vents

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Fixed metal wall louvers.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 07 Section "Joint Sealants" for sealants installed in perimeter joints between louver frames and adjoining construction.
2. Section "Metal Ductwork" for ductwork connected to metal wall louvers.

1.3 DEFINITIONS

A. Louver Terminology: Refer to Air Movement and Control Association (AMCA) 501 for definitions of terms for metal louvers not otherwise defined in this Section or in referenced standards.

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance: Engineer, fabricate, and install exterior metal wall louvers to withstand the effects of loads and stresses from wind and normal thermal movement without evidencing permanent deformation of louver components including blades, frames, and supports; noise or metal fatigue caused by louver blade rattle or flutter; or permanent damage to fasteners and anchors.

1. Wind Load: Uniform pressure (velocity pressure) of 20 lbf per sq. ft. (960 Pa), acting inwards or outwards.
2. Normal thermal movement is defined as that resulting from the following maximum change (range) in ambient temperature. Base design calculations on actual surface temperatures of metals due to both solar heat gain and nighttime sky heat loss.

a. Temperature Change (Range): 100 deg F (56 deg C).

B. Air-Performance, Water-Penetration, and Air-Leakage Ratings: Provide louvers complying with performance requirements indicated as demonstrated by testing manufacturer's stock units of height and width indicated. Test units according to AMCA 500.

1. Perform testing on unpainted, cleaned, degreased units.
2. Perform water-penetration testing on louvers without screens.
3. Equivalent Air-Performance Ratings: Louvers having less free area than that specified or having a lower free area velocity at the static pressure loss specified may be considered for the Work provided their total air performance is equivalent to that specified. The burden of proof of equivalency is on the Contractor. For louvers to be considered equivalent, the product of their free area, for the size specified, and their free area velocity at the static pressure loss specified must be at least equal to the product of the specified free area and

velocity. Also, their free area velocity at the static pressure loss specified must not result in water penetration of more than 0.01 oz. per sq. ft. (3.1 g/sq. m) of free area, and they must meet all other requirements.

1.5 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract.

B. Product data for each type of product specified.

C. Shop drawings of louver units and accessories. Include plans, elevations, sections, and details showing profiles, angles, and spacing of louver blades; unit dimensions related to wall openings and construction; free areas for each size indicated; profiles of frames at jambs, heads, and sills; and anchorage details and locations.

1. For installed products indicated to comply with certain design loadings, include structural analysis data sealed and signed by the qualified professional engineer who was responsible for their preparation.

D. Samples for initial selection in the form of manufacturer's color charts showing the full range of colors available for units with factory-applied color finishes.

E. Samples for verification of each type of metal finish required, prepared on samples of same thickness and material indicated for final unit of Work. Where finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.

F. Product test reports evidencing compliance of units with performance requirements indicated.

G. Product certificates signed by louver manufacturers certifying that their products comply with the specified requirements and are licensed to bear the AMCA seal based on tests made according to AMCA 500 and complying with the AMCA Certified Ratings Program.

H. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience.

1.6 QUALITY ASSURANCE

A. Single-Source Responsibility: Obtain louvers and vents from one source and by a single manufacturer where alike in one or more respects regarding type, design, and factory-applied color finish.

B. Welding Standards: Comply with applicable provisions of D1.2 "Structural Welding Code--Aluminum," and D1.3 "Structural Welding Code--Sheet Steel."

C. Engineer Qualifications: A professional engineer legally authorized to practice in the jurisdiction where the Project is located and experienced in providing engineering services of the kind indicated that have resulted in the installation of louvers similar to this Project in material, design, and extent and that have a record of successful in-service performance.

D. SMACNA Standard: Comply with SMACNA "Architectural Sheet Metal Manual" recommendations for fabrication, construction details, and installation procedures.

1.7 PROJECT CONDITIONS

A. Field Measurements: Check actual louver openings by accurate field measurements before fabrication, and show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Where field measurements cannot be made without delaying the Work, guarantee opening dimensions and proceed with fabricating louvers without field measurements. Coordinate construction to ensure that actual opening dimensions correspond to guaranteed dimensions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

1. Louvers:

a. Airline Products Co.
b. Airolite Co.
c. Airstream Products Div., Penn Ventilator Co., Inc.
d. All-Lite Louver Co.
e. American Warming and Ventilating, Inc.
f. Arrow United Industries.
g. Construction Specialties, Inc.
h. Greenheck Fan Corp.
i. Industrial Louvers, Inc.
j. Reliable Metal Products, Div. of Hart & Cooley, Inc.
k. Ruskin Mfg., Tomkins Industries, Inc.

2.2 MATERIALS

A. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T5 or T-52.

B. Fasteners: Of same basic metal and alloy as fastened metal or 300 series stainless steel, unless otherwise indicated. Do not use metals that are corrosive or incompatible with joined materials.

1. Use types and sizes to suit unit installation conditions.
2. Use Phillips flat-head screws for exposed fasteners, unless otherwise indicated.

C. Anchors and Inserts: Of type, size, and material required for type of loading and installation indicated. Use nonferrous metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or expansion bolt devices for drilled-in-place anchors.

2.3 FABRICATION, GENERAL

A. General: Fabricate louvers and vents to comply with requirements indicated for design, dimensions, materials, joinery, and performance.

B. Assemble louvers in shop to minimize field splicing and assembly. Disassemble units as

necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

C. Maintain equal louver blade spacing to produce uniform appearance.

D. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances of louvers, adjoining construction, and perimeter sealant joints.

E. Include supports, anchorages, and accessories required for complete assembly.

F. Provide sill extensions and loose sills made of same material as louvers where indicated or required for drainage to exterior and to prevent water penetrating to interior.

G. Join frame members to one another and to fixed louver blades as follows, unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary:

1. With fillet welds, concealed from view; or mechanical fasteners; or a combination of these methods; as standard with louver manufacturer.

2.4 FIXED, EXTRUDED-ALUMINUM WALL LOUVERS

A. Horizontal, Drainable, Fixed-Blade Louvers: Extruded-aluminum frames and louver blades, designed to collect and drain water to exterior at sill by means of gutters in front edges of blades and channels in jambs and mullions, complying with the following requirements:

1. Louver Depth: 4 inches (100 mm), unless otherwise indicated.
2. Frame Thickness: 0.125 inch (3.18 mm), unless otherwise indicated.
3. Blade Thickness: 0.125 inch (3.18 mm), unless otherwise indicated.
4. Blade Angle: 45 degrees, unless otherwise indicated.
5. Performance Requirements: As follows, determined by testing units 48 inches (1220 mm) wide by 48 inches (1220 mm) high per AMCA 500:

a. Free Area: Not less than 7.50 sq. ft. (0.697 sq. m).
b. Static Pressure Loss: Not more than 0.14 inch wg (35 Pa) at an airflow of 900 fpm (4.57 m/s) free area intake velocity.
c. Water Penetration: Not more than 0.01 oz. per sq. ft. (3.1 g/sq. m) of free area at an airflow of 900 fpm (4.57 m/s) free area velocity when tested for 15 minutes.

6. AMCA Seal: Mark units with the AMCA Certified Ratings Seal.

2.5 FINISHES, GENERAL

A. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to applying and designating finishes.

B. Finish louvers after assembly.

2.6 ALUMINUM FINISHES

A. Finish shall be Kynar 500 in color selected by the Architect to match the surrounding wall material.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.2 INSTALLATION

A. Locate and place louver units plumb, level, and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

C. Form closely fitted joints with exposed connections accurately located and secured.

D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

E. Repair finishes damaged by cutting, welding, soldering, and grinding operations required for fitting and jointing. Restore finishes so there is no evidence of corrective work. Return items that cannot be refinished in the field to the shop, make required alterations, and refinish entire unit, or provide new units.

F. Install concealed gaskets, flashings, joint fillers, and insulation, as louver installation progresses, where required to make louver joints weathertight. Comply with Division 7 Section "Joint Sealants" for sealants applied during installation of louver.

3.3 ADJUSTING AND PROTECTION

A. Protect louvers and vents from damage of any kind during construction period including use of temporary protective coverings where needed and approved by louver manufacturer. Remove protective covering at time of Substantial Completion.

B. Restore louvers and vents damaged during installation and construction period, so that no evidence remains of correction work. If results of restoration are unsuccessful, as judged by Architect, remove damaged units and replace with new units.

1. Clean and touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

3.4 CLEANING

A. Periodically clean exposed surfaces of louvers and vents that are not protected by temporary covering to remove fingerprints and soil during construction period. Do not let soil accumulate until final cleaning.

B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Rinse surfaces thoroughly and dry.

END OF SECTION

DIVISION 09 00 00: FINISHES
Section 09 21 16: Gypsum Board Assemblies

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Non-load-bearing steel framing members for gypsum board assemblies.
2. Gypsum board assemblies attached to steel framing.
3. Cementitious backer units installed with gypsum board assemblies.
4. Glass-mat, water-resistant exterior gypsum backing board installed with gypsum board assemblies.
5. Gypsum board sheathing.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 7 Section "Firestopping" for firestopping systems and fire-resistive-rated joint sealants.
2. Division 9 Section "Tile" for cementitious backer units installed as substrates for ceramic tile.

1.3 DEFINITIONS

A. Gypsum Board Construction Terminology: Refer to ASTM C 11 and GA-505 for definitions of terms related to gypsum board assemblies not defined in this Section or in other referenced standards.

1.4 ASSEMBLY PERFORMANCE REQUIREMENTS

A. Sound Transmission Characteristics: For gypsum assemblies indicated to have STC ratings, provide materials and construction identical to those of assemblies whose STC ratings were determined per ASTM E 90 and classified per ASTM E 413 by a qualified independent testing agency. Utilize USG RC-1 furring channels where shown on drawings for sound deadening wall construction.

1.5 SUBMITTALS

A. General: Submit the following according to Conditions of the Contract.

B. Product data for each type of product specified.

C. Product certificates signed by manufacturers of gypsum board assembly components certifying that their products comply with specified requirements.

1.6 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Where fire-rated gypsum board assemblies are indicated,

provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

1. Fire Resistance Ratings: As indicated by reference to GA File Numbers in GA-600 "Fire Resistance Design Manual" or to design designations in UL "Fire Resistance Directory" or in the listing of another testing and inspecting agency acceptable to authorities having jurisdiction.

B. Single-Source Responsibility for Steel Framing: Obtain steel framing members for gypsum board assemblies from a single manufacturer.

C. Single-Source Responsibility for Panel Products: Obtain each type of gypsum board and other panel products from a single manufacturer.

D. Single-Source Responsibility for Finishing Materials: Obtain finishing materials from either the same manufacturer that supplies gypsum board and other panel products or from a manufacturer acceptable to gypsum board manufacturer.

E. Field Samples: On actual gypsum board assemblies, prepare field samples of at least 100 sq. ft. in surface area for the following applications. Simulate finished lighting conditions for review of in-place unit of Work.

1. Wall surfaces indicated to receive nontextured paint finishes.
2. Ceiling surfaces indicated to receive nontextured paint finishes.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.

B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Neatly stack gypsum panels flat to prevent sagging.

C. Handle gypsum board to prevent damage to edges, ends, and surfaces. Do not bend or otherwise damage metal corner beads and trim.

1.8 PROJECT CONDITIONS

A. Environmental Conditions, General: Establish and maintain environmental conditions for applying and finishing gypsum board to comply with ASTM C 840 and with gypsum board manufacturer's recommendations.

B. Room Temperatures: For nonadhesive attachment of gypsum board to framing, maintain not less than 40 deg F (4 deg C). For adhesive attachment and finishing of gypsum board, maintain not less than 50 deg F (10 deg C) for 48 hours prior to application and continuously after until dry. Do not exceed 95 deg F (35 deg C) when using temporary heat sources.

C. Ventilation: Ventilate building spaces, as required, for drying joint treatment materials. Avoid drafts during hot dry weather to prevent finishing materials from drying too rapidly.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

1. Steel Framing and Furring:

   a. Alabama Metal Industries Corp.
   b. Dietrich Industries, Inc.
   c. Gold Bond Building Products Div., National Gypsum Co.

2. Grid Suspension Assemblies:

   a. Chicago Metallic Corp.
   b. National Rolling Mills Co.
   c. USG Interiors, Inc.

3. Gypsum Board and Related Products:

   a. Georgia-Pacific Corp.
   b. Gold Bond Building Products Div., National Gypsum Co.
   c. United States Gypsum Co.

2.2 STEEL FRAMING COMPONENTS FOR SUSPENDED AND FURRED CEILINGS

A. General: Provide components complying with ASTM C 754 for materials and sizes unless otherwise indicated.

B. Cast-In-Place and Postinstalled Anchors in Concrete: Anchors of type indicated below, fabricated from corrosion-resistant materials, with holes or loops for attaching hanger wires, and with capability to sustain, without failure, a load equal to 5 times that imposed by ceiling construction, as determined from testing per ASTM E 488 conducted by a qualified independent testing agency.

1. Cast-in-place type designed for attachment to concrete forms.
2. Chemical anchor.
3. Expansion anchor.

C. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190 conducted by a qualified testing agency.

D. Wire for Hangers and Ties: ASTM A 641, Class 1 zinc coating, soft temper.

E. Hanger Rods: Mild steel and zinc-coated or protected with rust-inhibitive paint.

F. Flat Hangers: Mild steel and zinc-coated or protected with rust-inhibitive paint.

G. Angle-Type Hangers: Angles with legs not less than 7/8 inch wide, formed from 0.0635-inch-thick galvanized steel sheet complying with ASTM A 446 Coating Designation G90, with bolted connections and 5/16-inch-diameter bolts.

H. Channels: Cold-rolled steel, 0.05980-inch-minimum thickness of base (uncoated) metal and 7/16-inch-wide flanges, and as follows:

1. Carrying Channels: 2 inches deep, 590 lb per 1000 feet, unless otherwise indicated.
2. Carrying Channels: 1-1/2 inch deep, 475 lb per 1000 feet, unless otherwise indicated.
3. Furring Channels: 3/4 inch deep, 300 lb per 1000 feet, unless otherwise indicated.
4. Finish: Rust-inhibitive paint, unless otherwise indicated.
5. Finish: G-60 hot-dip galvanized coating per ASTM A 525 for framing for exterior soffits and where indicated.

I. Steel Studs for Furring Channels: ASTM C 645, with flange edges bent back 90 deg and doubled over to form 3/16-inch minimum lip (return), minimum thickness of base (uncoated) metal and minimum depth as follows:

1. Thickness: As indicated.
2. Depth: As indicated.
3. Protective Coating: Manufacturer's standard corrosion-resistant coating.

J. Steel Rigid Furring Channels: ASTM C 645, hat-shaped, depth of 7/8 inch, and minimum thickness of base (uncoated) metal as follows:

1. Thickness: As indicated.
2. Protective Coating: Manufacturer's standard corrosion-resistant coating.

K. Grid Suspension System for Interior Ceilings: ASTM C 645, manufacturer's standard direct-hung grid suspension system composed of main beams and cross furring members that interlock to form a modular supporting network.

2.3 STEEL FRAMING FOR WALLS AND PARTITIONS

A. General: Provide steel framing members complying with the following requirements:

1. Component Sizes and Spacings: As indicated but not less than that required to comply with ASTM C 754 under the following maximum deflection and lateral loading conditions:

a. Maximum Deflection: L/240 at 5 lbf per sq. ft.

2. Protective Coating: Manufacturers standard corrosion-resistant coating.

B. Steel Studs and Runners: ASTM C 645, with flange edges of studs bent back 90 deg and doubled over to form 3/16-inch-wide minimum lip (return) and complying with the following requirements for minimum thickness of base (uncoated) metal and for depth:

1. Thickness: 0.0179 inch, unless otherwise indicated.
2. Depth: As indicated.

C. Steel Rigid Furring Channels: ASTM C 645, hat-shaped, depth and minimum thickness of base (uncoated) metal as follows:

1. Depth: 7/8 inch.
2. Thickness: 0.0179 inch, unless otherwise indicated.

D. Furring Brackets: Serrated-arm type, adjustable, fabricated from corrosion-resistant steel sheet

complying with ASTM C 645, minimum thickness of base (uncoated) metal of 0.0329 inch, designed for screw attachment to steel studs and steel rigid furring channels used for furring.

E. Z-Furring Members: Manufacturer's standard Z-shaped furring members with slotted or nonslotted web, fabricated from steel sheet complying with ASTM A 525 or ASTM A 568; with a minimum base metal (uncoated) thickness of 0.0179 inch, face flange of 1-1/4 inch, wall-attachment flange of 7/8 inch, and of depth required to fit insulation thickness indicated.

F. Fasteners for Metal Framing: Provide fasteners of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel framing and furring members securely to substrates involved; complying with the recommendations of gypsum board manufacturers for applications indicated.

2.4 GYPSUM SHEATHING BOARD

A. Gypsum Sheathing Board with Water-Resistant Core: Gypsum sheathing board consisting of noncombustile gypsum core incorporating a water-resistant material surfaced on face, back, and long edges with water-repellent paper bonded to the core equal to DensGlass Gold exterior sheathing as manufactured by Georgia-Pacific or approved equal. Comply with ASTM C 79 and requirements indicated below:

1. Type: Regular
2. Edge and End Configuration: Square
3. Thickness: 5/8 inch or as indicated.
4. Size: As indicated.

2.5 GYPSUM BOARD PRODUCTS

A. General: Provide gypsum board of types indicated in maximum lengths available to minimize end-to-end butt joints.

1. Thickness: Provide gypsum board in thicknesses indicated or, if not otherwise indicated, in either 1/2 inch or 5/8 inch thicknesses to comply with ASTM C 840 for application system and support spacing indicated.

B. Gypsum Wallboard: ASTM C 36 and as follows:

1. Type: Regular for vertical surfaces, unless otherwise indicated.
2. Type: Type X where required for fire-resistive-rated assemblies.
3. Type: Sag-resistant type for ceiling surfaces.
4. Edges: Tapered.
5 Thickness: As indicated.
6. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work where proprietary gypsum wallboard is indicated include, but are not limited to, the following:

a. Gyprock Fireguard C Gypsum Board, Domtar Gypsum.
b. Firestop Type C, Georgia-Pacific Corp.
c. Fire-Shield G, Gold Bond Building Products Div., National Gypsum Co.
d. SHEETROCK Brand Gypsum Panels, FIRECODE Core, United States Gypsum Co.
e. SHEETROCK Brand Gypsum Panels, ULTRACODE Core, United States Gypsum Co.

C. Gypsum Backing Board for Multilayer Applications: ASTM C 442 or, where backing board is not available from manufacturer, gypsum wallboard, ASTM C 36 and as follows:

1. Type: Regular for vertical surfaces, unless otherwise indicated.
2. Type: Type X where indicated or required for fire-resistive-rated assemblies.
3. Type: Sag-resistant type for ceiling surfaces, unless otherwise indicated.
4. Edges: Manufacturer's standard.
5. Thickness: As indicated.

D. Water-Resistant Gypsum Backing Board: ASTM C 630 and as follows:

1. Type: Regular, unless otherwise indicated.
2. Type: Type X where required for fire-resistive-rated assemblies.
3. Thickness: As indicated.

E. Exterior Gypsum Soffit Board: ASTM C 931, with manufacturer's standard edges, of type and thickness indicated below:

1. Type: Regular, unless otherwise indicated.
2. Type: Type X where required for fire-resistive-rated assemblies.
3. Thickness: 5/8 inch, unless otherwise indicated.

F. Glass-Mat Water-Resistant Gypsum Backing Board: ASTM C 1178, of type and thickness indicated below:

1. Type and Thickness: Regular, 1/2 inch thick, unless otherwise indicated.
2. Type and Thickness: Type X, 5/8 inch thick, for fire-resistive-rated assemblies.
3. Available Product: Subject to compliance with requirements, a product that may be incorporated in the Work is Dens-Shield Tile Backer units manufactured by Georgia Pacific Corp.

2.6 TRIM ACCESSORIES

A. Accessories for Interior Installation: Corner beads, edge trim, and control joints complying with ASTM C 1047 and requirements indicated below:

1. Material: Formed metal, plastic, or metal combined with paper, with metal complying with the following requirement:

a. Sheet steel zinc-coated by hot-dip process.

2. Shapes indicated below by reference to Fig. 1 designations in ASTM C 1047:

a. Cornerbead on outside corners, unless otherwise indicated.
b. LC-bead with both face and back flanges; face flange formed to receive joint compound. Use LC-beads for edge trim unless otherwise indicated.
c. L-bead with face flange only; face flange formed to receive joint compound. Use L-bead where indicated.
d. U-bead with face and back flanges; face flange formed to be left without application of joint compound. Use U-bead where indicated.
e. One-piece control joint formed with V-shaped slot, with removable strip covering slot opening.

2.7 JOINT TREATMENT MATERIALS

A. General: Provide joint treatment materials complying with ASTM C 475 and the recommendations of both the manufacturers of sheet products and of joint treatment materials for each application indicated.

B. Joint Tape for Gypsum Board: Paper reinforcing tape, unless otherwise indicated.

1. Use pressure-sensitive or staple-attached open-weave glass-fiber reinforcing tape with compatible joint compound where recommended by manufacturer of gypsum board and joint treatment materials for application indicated.

C. Joint Tape for Cementitious Backer Units: Polymer-coated, open glass-fiber mesh.

D. Setting-Type Joint Compounds for Gypsum Board: Factory-packaged, job-mixed, chemical-hardening powder products formulated for uses indicated.

1. Where setting-type joint compounds are indicated as a taping compound only or for taping and filling only, use formulation that is compatible with other joint compounds applied over it.
2. For prefilling gypsum board joints, use formulation recommended by gypsum board manufacturer for this purpose.
3. For filling joints and treating fasteners of water-resistant gypsum backing board behind base for ceramic tile, use formulation recommended by the gypsum board manufacturer for this purpose.
4. For topping compound, use sandable formulation.

E. Joint Compound for Cementitious Backer Unit: Material recommended by cementitious backer unit manufacturer.

2.8 MISCELLANEOUS MATERIALS

A. General: Provide auxiliary materials for gypsum board construction that comply with referenced standards and recommendations of gypsum board manufacturer.

B. Laminating Adhesive: Special adhesive or joint compound recommended for laminating gypsum panels.

C. Spot Grout: ASTM C 475, setting-type joint compound recommended for spot grouting hollow metal door frames.

D. Fastening Adhesive for Wood: ASTM C 557.

E. Fastening Adhesive for Metal: Special adhesive recommended for laminating gypsum panels to steel framing.

F. Steel drill screws complying with ASTM C 1002 for the following applications:

1. Fastening gypsum board to steel members less than 0.03 inch thick.
2. Fastening gypsum board to wood members.
3. Fastening gypsum board to gypsum board.

G. Steel drill screws complying with ASTM C 954 for fastening gypsum board to steel members from 0.033 to 0.112 inch thick.

H. Corrosion-resistant-coated steel drill screws of size and type recommended by board manufacturer for fastening cementitious backer units.

I. Gypsum Board Nails: ASTM C 514.

J. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to which gypsum board assemblies attach or abut, installed hollow metal frames, cast-in-anchors, and structural framing with Installer present for compliance with requirements for installation tolerances and other conditions affecting performance of assemblies specified in this Section. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Ceiling Anchorages: Coordinate installation of ceiling suspension systems with installation of overhead structural assemblies to ensure that inserts and other provisions for anchorages to building structure have been installed to receive ceiling hangers that will develop their full strength and at spacing required to support ceilings.

1. Furnish concrete inserts and other devices indicated to other trades for installation well in advance of time needed for coordination with other construction.

3.3 INSTALLING STEEL FRAMING, GENERAL

A. Steel Framing Installation Standard: Install steel framing to comply with ASTM C 754 and with ASTM C 840 requirements that apply to framing installation.

B. Install supplementary framing, blocking, and bracing at terminations in gypsum board assemblies to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction. Comply with details indicated and with recommendations of gypsum board manufacturer or, if none available, with "Gypsum Construction Handbook" published by United States Gypsum Co.

C. Isolate steel framing from building structure at locations indicated to prevent transfer of loading imposed by structural movement. Comply with details shown on Drawings.

1. Where building structure abuts ceiling perimeter or penetrates ceiling.
2. Where partition framing and wall furring abut structure except at floor.

a. Provide slip- or cushioned-type joints as detailed to attain lateral support and avoid axial loading.

D. Do not bridge building expansion and control joints with steel framing or furring members. Independently frame both sides of joints with framing or furring members as indicated.

3.4 INSTALLING STEEL FRAMING FOR SUSPENDED AND FURRED CEILINGS

A. Suspend ceiling hangers from building structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or ceiling suspension system. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with the location of hangers required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
3. Secure wire hangers by looping and wire-tying, either directly to structures or to inserts, eyescrews, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause them to deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
4. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eyescrews, or other devices and fasteners that are secure and appropriate for structure as well as for type of hanger involved, and in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
5. Do not support ceilings directly from permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
6. Do not attach hangers to steel deck tabs.
7. Do not attach hangers to steel roof deck. Attach hangers to structural members.
8. Do not connect or suspend steel framing from ducts, pipes or conduit.

B. Sway-brace suspended steel framing with hangers used for support.

C. Install suspended steel framing components in sizes and at spacings indicated but not less than that required by the referenced steel framing installation standard.

1. Wire Hangers: 0.1620-inch (8-gage) diameter, 4 feet o.c.
2. Carrying Channels (Main Runners)): 1-1/2 inch, 4 feet o.c.
3. Rigid Furring Channels (Furring Members): 24 inches o.c.

D. Installation Tolerances: Install steel framing components for suspended ceilings so that cross-furring members or grid suspension members are level to within 1/8 inch in 12 feet as measured both lengthwise on each member and transversely between parallel members.

E. Wire-tie or clip furring members to main runners and to other structural supports as indicated.

F. Grid Suspension System: Attach perimeter wall track or angle where grid suspension system meets vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

3.5 INSTALLING STEEL FRAMING FOR WALLS AND PARTITIONS

A. Install runners (tracks) at floors, ceilings, and structural walls and columns where gypsum board stud assemblies abut other construction.

1. Where studs are installed directly against exterior walls, install asphalt felt strips between studs and wall.

B. Installation Tolerances: Install each steel framing and furring member so that fastening surfaces do not vary more than 1/8 inch from the plane formed by the faces of adjacent framing.

C. Extend partition framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Cut studs 1/2 inch short of full height. Continue framing over frames for doors and openings and frame around ducts penetrating partitions above ceiling to provide support for gypsum board.

1. For STC-rated and fire-resistive-rated partitions requiring partitions to extend to the underside of floor/roof slabs and decks or other continuous solid structural surfaces to obtain ratings, install framing around structural and other members extending below floor/roof slabs and decks, as needed, to support gypsum board closures needed to make partitions continuous from floor to underside of solid structure.

D. Terminate partition framing at suspended ceilings where indicated.

E. Install steel studs and furring in sizes and at spacings indicated but not less than that required by the referenced steel framing installation standard to comply with maximum deflection and minimum loading requirements specified:

1. Single-Layer Construction: Space studs at 16 inches o.c.
2. Single-Layer Construction: Space studs at 24 inches o.c.
3. Single- and Double-Layer Construction: Space studs at 24 inches o.c.

F. Install steel studs so that flanges point in the same direction and so that leading edges or ends of each gypsum board can be attached to open (unsupported) edges of stud flanges first.

G. Frame door openings to comply with details indicated, with GA-219, and with applicable published recommendations of gypsum board manufacturer. Attach vertical studs at jambs with screws either directly to frames or to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.

1. Extend vertical jamb studs through suspended ceilings and attach to underside of floor or roof structure above.

H. Frame openings other than door openings to comply with details indicated or, if none indicated, in same manner as required for door openings. Install framing below sills of openings to match framing required above door heads.

I. Install thermal insulation as follows:

1. Erect insulation vertically and hold in place with Z-furring members spaced 24 inches o.c.
2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw attach short flange of furring channel to web of attached channel. Start from this furring channel with standard width insulation panel and continue in regular manner. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.
4. Until gypsum board is installed, hold insulation in place with 10-inch staples fabricated from 0.0625-inch (16-gage) diameter tie wire and inserted through slot in web of member.

3.6 APPLYING AND FINISHING GYPSUM BOARD, GENERAL

A. Gypsum Board Application and Finishing Standards: Install and finish gypsum panels to comply with ASTM C 840 and GA-216.

B. Install ceiling board panels across framing to minimize the number of abutting end joints and avoid abutting end joints in the central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install wall/partition board panels to minimize the number of abutting end joints or avoid them entirely. Stagger abutting end joints not less than one framing member in alternate courses of board. At stairwells and other high walls, install panels horizontally with end abutting joints over studs and staggered.

D. Install gypsum panels with face side out. Do not install imperfect, damaged, or damp panels. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

E. Locate both edge or end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Position adjoining panels so that tapered edges abut tapered edges, and field-cut edges abut field-cut edges and ends. Do not place tapered edges against cut edges or ends. Stagger vertical joints over different studs on opposite sides of partitions. Avoid joints at corners of framed openings where possible.

F. Attach gypsum panels to steel studs so that the leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

G. Attach gypsum panels to framing provided at openings and cutouts.

H. Do not attach gypsum panels across the flat grain of wide-dimension lumber including floor joists and headers. Instead, float gypsum panels over these members using resilient channels or provide control joints to counteract wood shrinkage.

I. Spot grout hollow metal door frames for solid core wood doors, hollow metal doors, and doors over 32 inches wide. Apply spot grout at each jamb anchor clip and immediately insert gypsum panels into frames.

J. Form control joints and expansion joints at locations indicated and as detailed, with space between edges of adjoining gypsum panels, as well as supporting framing behind gypsum panels.

K. Cover both faces of steel stud partition framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chase walls that are braced internally.

1. Except where concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect open concrete coffers, concrete joists, and other structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by coffers, joists, and other structural members; allow 1/4-to-1/2-inch-wide joints to install sealant.

L. Isolate perimeter of non-load-bearing gypsum board partitions at structural abutments, except floors, as detailed. Provide 1/4-inch-to-1/2-inch-wide spaces at these locations and trim edges with U-bead edge trim where edges of gypsum panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

M. Floating Construction: Where feasible, including where recommended by manufacturer, install gypsum panels over wood framing, with floating internal corner construction.

N. Where STC-rated gypsum board assemblies are indicated, seal construction at perimeters, behind control and expansion joints, openings, and penetrations with a continuous bead of acoustical sealant including a bead at both faces of the partitions. Comply with ASTM C 919 and manufacturer's recommendations for location of edge trim and closing off sound-flanking paths around or through gypsum board assemblies, including sealing partitions above acoustical ceilings.

O. Space fasteners in gypsum panels according to referenced gypsum board application and finishing standard and manufacturer's recommendations.

3.7 GYPSUM BOARD APPLICATION METHODS

A. Single-Layer Application: Install gypsum wallboard panels as follows:

1. On ceilings, apply gypsum panels prior to wall/partition board application to the greatest extent possible and at right angles to framing, unless otherwise indicated.
2. On partitions/walls, apply gypsum panels vertically (parallel to framing), unless otherwise indicated, and provide panel lengths that will minimize end joints.
3. On partitions/walls, apply gypsum panels horizontally (perpendicular to framing), unless parallel application is required for fire-resistive-rated assemblies. Use maximum-length panels to minimize end joints.
4. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.

B. Wall Tile Substrates: For substrates indicated to receive thin-set ceramic tile and similar rigid applied wall finishes, comply with the following:

1. Install glass-mat water-resistant gypsum backing board panels to comply with manufacturer's installation directions.
2. Install glass-mat water-resistant gypsum backing board panels at showers, tubs, and where indicated to comply with board manufacturer's installation instructions.
3. Install gypsum wallboard panels with tapered edges taped and finished to produce a flat surface except at showers, tubs, and other locations indicated to receive water-resistant panels.

C. Double-Layer Application: Install gypsum backing board for base layers and gypsum wallboard for face layers.

1. On ceilings, apply base layer prior to applying base layer on walls/partitions; apply face layers in same sequence. Offset face-layer joints at least 10 inches from parallel base-layer joints. Apply base layers at right angles to framing members unless otherwise indicated.
2. On partitions/walls, apply base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face layer joints offset at least one stud or furring member with base layer joints. Stagger joints on opposite sides of partitions.
3. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.

D. Acoustical Tile Base: Where gypsum panels form the base for adhesively applied acoustical tile, install gypsum wallboard panels.

E. Single-Layer Fastening Methods: Apply gypsum panels to supports as follows:

1. Fasten with screws.

F. Double-Layer Fastening Methods: Apply base layer of gypsum panels and face layer to base layer as follows:

1. Fasten both base layers and face layers separately to supports with screws.

G. Direct-Bonding to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members or base layer of gypsum board), comply with gypsum board manufacturer's recommendations, and temporarily brace or fasten gypsum panels until fastening adhesive has set.

3.8 INSTALLING TRIM ACCESSORIES

A. General: For trim accessories with back flanges, fasten to framing with the same fasteners used to fasten gypsum board. Otherwise, fasten trim accessories according to accessory manufacturer's directions for type, length, and spacing of fasteners.

B. Install corner beads at external corners.

C. Install edge trim where edge of gypsum panels would otherwise be exposed or semiexposed. Provide edge trim type with face flange formed to receive joint compound except where other types are indicated.

1. Install LC-bead where gypsum panels are tightly abutted to other construction and back flange can be attached to framing or supporting substrate.
2. Install L-bead where edge trims can only be installed after gypsum panels are installed.
3. Install U-bead where indicated.
4. Install aluminum edge trim and other accessories where indicated.

D. Install control joints at locations indicated, and where not indicated according to ASTM C 840, and in locations approved by Architect for visual effect.

E. Install H-molding in exterior gypsum board assemblies where control joints are indicated. Install on cut or ends of gypsum panels, not on tapered edges.

3.9 FINISHING GYPSUM BOARD ASSEMBLIES

A. General: Apply joint treatment at gypsum board joints (both directions); flanges of corner bead, edge trim, and control joints; penetrations; fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration and levels of gypsum board finish indicated.

B. Prefill open joints, rounded or beveled edges, and damaged areas using setting-type joint compound.

C. Apply joint tape over gypsum board joints except those with trim accessories having concealed face flanges not requiring taping to prevent cracks from developing in joint treatment at flange edges.

D. Apply joint tape over gypsum board joints and to trim accessories with concealed face flanges as recommended by trim accessory manufacturer and as required to prevent cracks from developing

in joint compound at flange edges.

E. Levels of Gypsum Board Finish: Provide the following levels of gypsum board finish per GA-214.

1. Level 1 for ceiling plenum areas, concealed areas, and where indicated, unless a higher level of finish is required for fire-resistive-rated assemblies and sound-rated assemblies.
2. Level 2 where water-resistant gypsum backing board panels form substrates for tile, and where indicated.
3. Level 3 for gypsum board surfaces indicated to receive medium- or heavy-textured finishes before painting.
4. Level 4 for gypsum board surfaces indicated to receive light-textured finishes, wallcoverings, and flat paints over light textures.
5. Level 5 for gypsum board surfaces indicated to receive gloss and semigloss enamels, nontextured flat paints, and where indicated.

F. For level 4 gypsum board finish, embed tape in finishing compound plus two separate coats applied over joints, angles, fastener heads, and trim accessories using the following combination of joint compounds (not including prefill), and sand between coats and after last coat:

1. Embedding and First Coat: Setting-type joint compound.
2. Fill (Second) Coat: Setting-type joint compound.
3. Finish (Third) Coat: Sandable, setting-type joint compound.

G. Where level 5 gypsum board finish is indicated, apply joint compound combination specified for level 4 plus a thin, uniform skim coat of joint compound over entire surface. Use joint compound specified for the finish (third coat) or a product specially formulated for this purpose and acceptable to gypsum board manufacturer. Produce surfaces free of tool marks and ridges ready for decoration of type indicated.

H. Where level 3 gypsum board finish is indicated, apply joint compounds specified for first and second coat in addition to embedding coat.

I. Where level 2 gypsum board finish is indicated, apply joint specified for first coat in addition to embedding coat.

J. Where level 1 gypsum board finish is indicated, apply joint compound specified for embedding coat.

K. Finish exterior gypsum soffit board using setting-type joint compounds to prefill joints and embed tape, and for first, fill (second) and finish (third) coats, with the last coat being a sandable product. Smooth each coat before joint compound hardens to minimize need for sanding. Sand between coats and after finish coat.

1. Painting exterior gypsum soffit board after finish coat has dried is specified in Division 9 Section "Painting."

L. Finish water-resistant gypsum backing board forming base for ceramic tile to comply with ASTM C 840 and board manufacturer's directions for treatment of joints behind tile.

M. Finish glass-mat water-resistant gypsum backing board to comply with board manufacturer's directions.

3.10 CLEANING AND PROTECTION

A. Promptly remove any residual joint compound from adjacent surfaces.

B. Provide final protection and maintain conditions, in a manner suitable to Installer that ensures gypsum board assemblies remain without damage or deterioration at time of Final Acceptance.

END OF SECTION 09 21 16

DIVISION 9: FINISHES
Section 09 30 00: Tile

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Wall Tile.

B. Floor Tile.

C. Crack Isolation.

D. Stone thresholds.

E. Ceramic trim.

1.2 RELATED SECTIONS

A. Section 07 92 00 - Joint Sealants.

1.3 REFERENCES

A. ANSI A108.1A, 1999 - Specifications for Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar.

B. ANSI A108.1B, 1999 - Specifications for Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex Portland Cement Mortar.

C. ANSI A108.1C, 1999 - Specifications for Contractors Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar -or- Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex Portland Cement Mortar.

D. ANSI A108.4, 1999 - Specifications for Ceramic Tile Installed with Organic Adhesives or Water-Cleanable Tile Setting Epoxy Adhesive.

E. ANSI A108.5, 1999 - Specifications for Ceramic Tile Installed with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar.

F. ANSI A108.6, 1999 - Specifications for Ceramic Tile Installed with Chemical-Resistant, Water-Cleanable Tile-Setting and -Grouting Epoxy.

G. ANSI A108.8, 1999 - Specifications for Ceramic Tile Installed with Chemical-Resistant Furan Mortar and Grout.

H. ANSI A108.9, 1999 - Specifications for Ceramic Tile Installed with Modified Epoxy Emulsion Mortar/Grout.

I. ANSI A108.10, 1999 - Specifications for Installation of Grout in Tilework.

J. ANSI A118.1, 1999 - Standard Specification for Dry-Set Portland Cement Mortar.

K. ANSI A118.3, 1999 - Chemical-Resistant, Water-Cleanable, Tile-Setting and -Grouting Epoxy and Water-Cleanable Tile-Setting Epoxy Adhesive.

L. ANSI A118.4, 1999 - Latex-Portland Cement Mortar.

M. ANSI A118.5, 1999 - Chemical-Resistant Furan Mortar and Grout.

N. ANSI A118.6, 1999 - Standard Ceramic Tile Grouts.

O. ANSI A118.7, 1999 - Polymer Modified Cement Grouts

P. ANSI A118.8, 1999 - Modified Epoxy Emulsion Mortar/Grout.

Q. ANSI A118.9, 1999 - Test Methods and Specifications for Cementitious Backer Units

R. ANSI A118.10, 1999 - Load bearing, Bonded, Waterproof Membranes for Thinset Ceramic Tile and Dimensional Stone.

S. ANSI A118.11, 1999 - Exterior Grade Plywood (EGP) Latex-Portland Cement Mortar.

T. ANSI A136.1, 1999 - Organic Adhesives for Installation of Ceramic Tile.

U. ANSI A137.1, 1988 - Specifications for Ceramic Tile.

V. ASTM C50 - Standard Specification for Portland Cement.

W. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar.

X. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes.

Y. ASTM C241 - Test Method For Abrasion Resistance of Stone Subjected to Foot Traffic.

Z. ASMT C503 - Specification for Marble Building Stone (Exterior).

AA. ASTM C615 - Specification for Granite Dimension Stone.

BB. ASTM C629 - Specification for Slate Dimension Stone.

CC. ASTM C847 - Standard Specification for Metal Lath.

DD. ASTM C1028 - Test method for Determining the Static Coefficient of Friction or Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull meter Method.

EE. ASTM D4397 - Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications.

FF. TCA (HB) - Handbook for Ceramic Tile Installation; Tile Council of America, Inc.

1.4 PERFORMANCE REQUIREMENTS

A. Static Coefficient of Friction: Tile on walkway surfaces shall be provided with the following values as determined by testing in conformance with ASTM C 1028.
   1. Level Surfaces: Minimum of 0.6 (Wet).

1.5 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

C. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, ceramic accessories, and setting details.

D. Selection Samples: Color charts illustrating full range of colors and patterns.

E. Selection Samples: Samples of actual tiles for selection.

F. Manufacturer's Certificate:
1. Certify that products meet or exceed specified requirements.
2. For each shipment, type and composition of tile provide a Master Grade Certificate signed by the manufacturer and the installer certifying that products meet or exceed the specified requirements of ANSI A137.1.

G. Maintenance Data: Include recommended cleaning methods, cleaning materials, stain removal methods, and polishes and waxes.

1.6 QUALITY ASSURANCE

A. Maintain one copy each of all Referenced standards and specifications on site. Include the TCA Handbook, ANSI A108 Series, ANSI A118 Series ANSI A136.1 and ANSI A137.1 and others as specified under paragraph References.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years experience.

C. Single Source Responsibility:
1. Obtain each type and color of tile from a single source.
2. Obtain each type and color of mortar, adhesive and grout from the same source.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store products in manufacturer's unopened packaging until ready for installation.

B. Protect adhesives and liquid additives from freezing or overheating in accordance with manufacturer's instructions.

C. Store tile and setting materials on elevated platforms, under cover and in a dry location and protect from contamination, dampness, freezing or overheating.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Do not install adhesives in an unventilated environment.

B. Maintain ambient and substrate temperature of 50 degrees F (10 degrees C) during installation of mortar materials.

1.9 EXTRA MATERIALS

A. Provide 16 sq ft of each size, color, and surface finish of tile specified.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: DalTile Corporation or approved equal.

B. Requests for substitutions will be considered in accordance with provisions of the General Conditions of the Contract.

2.2 TILE

A. General: Provide tile that complies with ANSI A137.1 for types, compositions and other characteristics indicated. Provide tile in the locations and of the types colors and pattern indicated on the Drawings and identified in the Schedule and the end of this Section. Tile shall also be provided in accordance with the following:
   1. Factory Blending: For tile exhibiting color variations within the ranges selected under Submittal of samples, blend tile in the factory and package so tile taken from one package shows the same range of colors as those taken from other packages.
   2. Mounting: For factory mounted tile, provide back or edge mounted tile assemblies as standard with the manufacturer, unless otherwise specified.
   3. Factory Applied Temporary Protective Coatings: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating with a continuous film of petroleum paraffin wax applied hot. Do not coat unexposed tile surfaces.

B. Glazed Backsplash Wall Tile: ANSI A137.1, and as follows:
   1. Product: Daltile, Color Wheel Collection, Linear Glazed Ceramic or approved equivalent.
   2. Moisture Absorption: Less than 20.0 percent.
   3. Size and Shape: 3”x6”, nominal.
   4. Colors: To be selected from manufacturer's standard range.
   5. Pattern: As shown on the drawings.
   6. Trim Units: Matching bead, bullnose, cove, and base shapes in sizes coordinated with field tile.

C. Shower Wall / Ceiling Tile: ANSI A137.1, and as follows:
   1. Product: South Cypress Calico, Crema
   2. Moisture Absorption: Less than 20.0 percent.
   3. Size and Shape: 12”x24” , nominal.
   4. Colors: To be selected from manufacturer's standard range.
   5. Pattern: As shown on the drawings.
   6. Trim Units: Matching bead, bullnose, cove, and base shapes in sizes coordinated with field tile.

D.

2.3 TRIM AND ACCESSORIES

A. Stone Thresholds: Provide stone thresholds uniform in color and finish and fabricated as follows:
   1. Material:
      a. Marble,complying with ASTM C 503 for exterior use and with a minimum abrasive hardness of 10 when tested in accordance with ASTM C 241.
   2. Color/Finish:
      a. As selected from the manufacturers standard range.
   3. Size:
      a. Fabricated in the sizes and profiles indicated.
   4. Provide to provide transition between tile surface and adjoining finishes and at the following locations:
      a. At open edges of floor tile where adjacent finish is a different height.

2.4 SETTING MATERIALS

A. Organic Adhesive: ANSI A136.1, thinset bond type; use Type I in areas subject to prolonged moisture exposure.

B. Mortar Bed Materials:
1. Portland cement: ASTM C150, type 1, gray or white.

C. Mortar Bond Coat Materials:
1. Latex-Portland Cement type: ANSI A118.4.

D. Standard Grout: Cement grout, sanded or unsanded, as specified in ANSI A118.6; color as selected.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that wall surfaces are free of substances which would impair bonding of setting materials, smooth and flat within tolerances specified in ANSI A137.1, and are ready to receive tile.

B. Verify that sub-floor surfaces are dust-free, and free of substances which would impair bonding of setting materials to sub-floor surfaces, and are smooth and flat within tolerances specified in ANSI A137.1.

C. Verify that concrete sub-floor surfaces are ready for tile installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are not within limits recommended by tile manufacturer and setting materials manufacturer.

D. Verify that required floor-mounted utilities are in correct location.

3.2 PREPARATION

A. Protect surrounding work from damage.

B. Remove any curing compounds or other contaminates.

C. Vacuum clean surfaces and damp clean.

D. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.

E. Prepare substrate surfaces for adhesive installation in accordance with adhesive manufacturer's instructions.

3.3 INSTALLATION - GENERAL

A. Install tile and grout in accordance with applicable requirements of ANSI A108.1 through A108.13, manufacturer's instructions, and TCA Handbook recommendations.

B. Lay tile to pattern indicated. Arrange pattern so that a full tile or joint is centered on each wall and that no tile less than 1/2 width is used. Do not interrupt tile pattern through openings.

C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.

D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make joints watertight, without voids, cracks, excess mortar, or excess grout.

E. Form internal angles square and external angles bullnosed.

F. Install ceramic accessories rigidly in prepared openings.

G. Install non-ceramic trim in accordance with manufacturer's instructions.

H. Install thresholds where indicated.

I. Sound tile after setting. Replace hollow sounding units.

J. Keep expansion joints free of adhesive or grout. Apply sealant to joints.

K. Allow tile to set for a minimum of 48 hours prior to grouting.

L. Grout tile joints. Use standard grout unless otherwise indicated.

M. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.

3.4 INSTALLATION - FLOORS - THIN-SET METHODS

A. Over exterior concrete substrates, install in accordance with TCA Handbook Method F102, with standard grout.

B. Over interior concrete substrates, install in accordance with TCA Handbook Method F113, dry-set or latex-portland cement bond coat, with standard grout, unless otherwise indicated.
   1. Where waterproofing membrane is indicated, install in accordance with TCA Handbook Method F122, with latex-portland cement grout.
   2. Where epoxy bond coat and grout are indicated, install in accordance with TCA Handbook Method F131.

3.5 INSTALLATION - FLOORS - MORTAR BED METHODS

A. Over interior concrete substrates, install in accordance with TCA Handbook Method F111, with cleavage membrane, unless otherwise indicated.
   1. Where waterproofing membrane is indicated, with standard grout or no mention of grout type, install in accordance with TCA Handbook Method F121.
   2. Where epoxy bond coat and grout are indicated, install in accordance with TCA Handbook Method F132, bonded.
   3. Where epoxy or furan grout is indicated, but not epoxy or furan bond coat, install in accordance with TCA Handbook Method F114, with cleavage membrane.

B. Cleavage Membrane: Lap edges and ends.

C. Waterproofing Membrane: Install as specified in ANSI A108.13.

D. Mortar Bed Thickness: 1-1/4 to 2 inch (32 to 51 mm) maximum, unless otherwise indicated.

3.6 INSTALLATION - SHOWERS AND BATHTUB WALLS

A. At tiled shower receptors install in accordance with TCA Handbook Method B415, mortar bed floor, and W244, thin-set over cementitious backer unit walls.

B. Grout with standard grout as specified above.

C. Seal joints between tile work and other work with sealant as specified in Section 07901.

3.7 INSTALLATION - WALL TILE

A. Over cementitious backer units install in accordance with TCA Handbook Method W223, organic adhesive. Cementitious backer units shall be equivalent to Hardibacker by James Hardie, Durock by USG, PermaBASE or prior approved equivalent.

B. Over interior concrete and masonry install in accordance with TCA Handbook Method W202, thin-set with dry-set or latex-portland cement bond coat.

3.8 INDUSTRIAL CLEANING OF EXISTING TILE SURFACES and PLUMBING FIXTURES

A. General Contractor shall be responsible for employing the services of a Professional Commercial Cleaning Company to perform mechanical chemical and steam cleaning of existing tile and grout surfaces, epoxy painted wall and ceiling surfaces, and plumbing fixtures scheduled to remain. Cleaning Service Company must have five (5) years experience performing like scope of work. Cleaning Service Company must be submitted and approved by the Owner and Architect prior to engagement.

3.9 PROTECTION OF FINISHED WORK

A. Do not permit traffic over finished floor surface for 72 hours after installation.

B. Cover floors with kraft paper and protect from dirt and residue from other trades.

C. Where floor will be exposed for prolonged periods cover with plywood or other similar type walkways until time of Final Acceptance by Owner.

END OF SECTION 09 30 00

DIVISION 9: FINISHES
Section 09 66 10: Linear Vinyl Tile

PART 1 GENERAL

1.01 THIS SECTION INCLUDES

A. Flooring and accessories as shown on the drawings and schedules and as indicated by the requirements of this section.

1.02 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract including General and Supplementary Conditions and Division 1 sections apply to the work of this section.

1.03 RELATED SECTIONS

A. Other Division 9 sections for floor finishes related to this section but not the work of this section.

1.04 QUALITY ASSURANCE AND REGULATORY REQUIREMENTS

A. Select an installer who is competent in the installation of resilient tile flooring.

B. If required, provide types of flooring and accessories supplied by one manufacturer, including leveling and patching compounds, and adhesives.

C. If required, provide flooring material to meet the following fire test performance criteria as tested by a recognized independent testing laboratory:

a. ASTM E 648 Critical Radiant Flux of 0.45 watts per sq. cm. or greater, Class I.

b. ASTM E 662 (Smoke Generation) Maximum Specific Optical Density of 450 or less.

1.05 SUBMITTALS

A. Submit shop drawings, seaming plan, coving details, and manufacturer's technical data, installation and maintenance instructions for flooring and accessories.

B. Submit the manufacturer's standard samples showing the required colors for flooring and applicable accessories.

C. If required, submit the manufacturer's certification that the flooring has been tested by an independent laboratory and complies with the required fire tests.

1.06 ENVIRONMENTAL CONDITIONS

A. Deliver materials in good condition to the jobsite in the manufacturer's original unopened containers that bear the name and brand of the manufacturer, project identification, and shipping and handling instructions.

B. Store materials in a clean, dry, enclosed space off the ground, and protected from the weather and from extremes of heat and cold. Protect adhesives from freezing. Store flooring, adhesives and accessories in the spaces where they will be installed for at least 48 hours before beginning installation.

C. Maintain a minimum temperature in the spaces to receive the flooring and accessories of 65ºF (18ºC) and a maximum temperature of 100ºF (38ºC) for at least 48 hours before, during, and for not less than 48 hours after installation. Thereafter, maintain a minimum temperature of 55ºF (13ºC) in areas where work is completed. Protect all materials from the direct flow of heat from hot-air registers, radiators, or other heating fixtures and appliances.

D. Install flooring and accessories after the other finishing operations, including painting, have

been completed. Close spaces to traffic during the installation of the flooring. Do not install flooring over concrete slabs until they are sufficiently dry to achieve a bond with the adhesive, in accordance with the manufacturer's recommended bond and moisture tests.

PART 2 - PRODUCTS

2.01 RESILIENT TILE FLOORING MATERIALS

A. LVT – 1 - Provide Tarkett ID Latitude, 6”.48” Chamois Oak, Basis of Design or approved equivalent.

2.03 ADHESIVES

A. For Tile Installation System, Full Spread: Provide Tile Adhesive under the tile as recommended by the flooring manufacturer.

2.04 ACCESSORIES

A. For sealing joints between the top of wall base or integral cove cap and irregular wall surfaces such as masonry, provide plastic filler applied according to the manufacturer's recommendations.

B. Provide transition/reducing strips tapered to meet abutting materials.

C. Provide threshold of thickness and width as shown on the drawings.

D. Provide resilient edge strips of width shown on the drawings, of equal gauge to the flooring, homogeneous vinyl or rubber composition, tapered or bullnose edge, with color to match or contrast with the flooring, or as selected by the Architect from standard colors available.

E. Provide metal edge strips of width shown on the drawings and of required thickness to protect exposed edges of the flooring. Provide units of maximum available length to minimize the number of joints. Use butt-type metal edge strips for concealed anchorage, or overlap-type metal edge strips for exposed anchorage. Unless otherwise shown, provide strips made of extruded aluminum with a mill finish.

PART 3 EXECUTION

3.01 INSPECTION

A. Examine subfloors prior to installation to determine that surfaces are smooth and free from cracks, holes, ridges, and other defects that might prevent adhesive bond or impair durability or appearance of the flooring material.

B. Inspect subfloors prior to installation to determine that surfaces are free from curing, sealing, parting and hardening compounds; residual adhesives; adhesive removers; and other foreign materials that might prevent adhesive bond. Visually inspect for evidence of moisture, alkaline salts, carbonation, dusting, mold, or mildew.

C. Report conditions contrary to contract requirements that would prevent a proper installation. Do not proceed with the installation until unsatisfactory conditions have been corrected.

D. Failure to call attention to defects or imperfections will be construed as acceptance and approval of the subfloor. Installation indicates acceptance of substrates with regard to conditions existing at the time of installation.

3.02 PREPARATION

A. Smooth concrete surfaces, removing rough areas, projections, ridges, and bumps, and filling low spots, control or construction joints, and other defects with as recommended by the flooring manufacturer.

B. Remove paint, varnish, oils, release agents, sealers, and waxes. Remove residual adhesives

as recommended by the flooring manufacturer. Remove curing and hardening compounds not compatible with the adhesives used, as indicated by a bond test or by the compound manufacturer's recommendations for flooring. Avoid organic solvents.

C. Perform subfloor moisture testing in accordance with ASTM F 2170, “Standard Test Method for Determining Relative Humidity in Concrete Slabs Using *in-situ* Probes” and Bond Tests to determine if surfaces are dry; free of curing and hardening compounds, old adhesive, and other coatings; and ready to receive flooring.

D. Vacuum or broom-clean surfaces to be covered immediately before the application of flooring. Make subfloor free from dust, dirt, grease, and all foreign materials.

E. Concrete Leveling and Patching:

Commercial Flooring Contractor is to include floor leveling and feathering finish as indicated on drawings.

Provide the following products for corrective concrete work: (Basis of Design or approved equivalent.)

Ardex K15 Self leveling Underlayment (All areas requiring corrective work as per plans.)
Ardex P-82 Ultra Prime and P-51 Primers (Use P-51 primer for concrete)
Ardex EP 2000 Epoxy Primer for terrazzo floors
Ardex E- 25 Additive
Ardex Feather Finish, self-drying, cement based finish underlayment.
Equal products manufactured by Laticrete and Pro-Spec are approved.

3.03 INSTALLATION OF TILE FLOORING

A. Install flooring in strict accordance with the manufacturers written instructions.

B. Install flooring wall to wall before the installation of floor-set cabinets, casework, furniture, equipment, movable partitions, etc. Extend flooring into toe spaces, door recesses, closets, and similar openings as shown on the drawings.

C. If required, install flooring on pan-type floor access covers. Maintain continuity of color and pattern within pieces of flooring installed on these covers. Adhere flooring to the subfloor around covers and to covers.

D. Scribe, cut, and fit to permanent fixtures, columns, walls, partitions, pipes, outlets, and built-in furniture and cabinets.

E. Install flooring with adhesives, tools, and procedures in strict accordance with the manufacturer's written instructions. Observe the recommended adhesive trowel notching, open times, and working times.

3.04 INSTALLATION OF ACCESSORIES

A. Place resilient edge strips tightly butted to flooring, and secure with adhesive recommended by the edge strip manufacturer. Install edge strips at edges of flooring that would otherwise be exposed.

B. Apply overlap metal edge strips where shown on the drawings, after flooring installation. Secure units to the substrate, complying with the edge strip manufacturer's recommendations.

3.05 CLEANING AND PROTECTION

A. Perform initial maintenance according to the manufacturer’s instructions.

B. Protect installed flooring as recommended by the flooring manufacturer against damage from rolling loads, other trades, or the placement of fixtures and furnishings.

END OF SECTION 09 66 00

DIVISION 09 00 00: FINISHES
Section 09 66 11: Resilient Tile Flooring

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Vinyl composition floor tile.

B. Resilient wall base, reducer strips, and other accessories installed with resilient floor tiles are specified in Division 9 Section "Resilient Wall Base and Accessories."

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract.

B. Product data for each type of product specified.

1. Certification by tile manufacturer that products supplied for tile installation comply with local regulations controlling use of volatile organic compounds (VOC's).

C. Samples for initial selection purposes in form of manufacturer's color charts consisting of actual tiles or sections of tiles showing full range of colors and patterns available for each type of resilient floor tile indicated.

D. Product certificates, in lieu of laboratory test reports when permitted by Architect, signed by manufacturer certifying that each product complies with requirements.

E. Maintenance data for resilient floor tile, to include in Operating and Maintenance Manual specified in Division 1.

1.4 QUALITY ASSURANCE

A. Single-Source Responsibility for Floor Tile: Obtain each type, color, and pattern of tile from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.

B. Fire Performance Characteristics: Provide resilient floor tile with the following fire performance characteristics as determined by testing products per ASTM test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

1. Smoke Density: Less than 450 per ASTM E 662.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver tiles and installation accessories to Project site in original manufacturer's unopened cartons and containers each bearing names of product and manufacturer, Project identification, and shipping and handling instructions.

B. Store flooring materials in dry spaces protected from the weather with ambient temperatures maintained between 50 deg F (10 deg C) and 90 deg F (32 deg C).

C. Store tiles on flat surfaces. Move tiles and installation accessories into spaces where they will be installed at least 48 hours in advance of installation.

1.6 PROJECT CONDITIONS

A. Maintain a minimum temperature of 70 deg F (21 deg C) in spaces to receive tiles for at least 48 hours prior to installation, during installation, and for not less than 48 hours after installation. After this period, maintain a temperature of not less than 55 deg F (13 deg C).

B. Do not install tiles until they are at the same temperature as the space where they are to be installed.

C. Close spaces to traffic during tile installation.

1.7 SEQUENCING AND SCHEDULING

A. Install tiles and accessories after other finishing operations, including painting, have been completed.

B. Do not install tiles over concrete slabs until the slabs have cured and are sufficiently dry to bond with adhesive as determined by tile manufacturer's recommended bond and moisture test.

1.8 EXTRA MATERIALS

A. Deliver extra materials to Owner. Furnish extra materials matching products installed as described below, packaged with protective covering for storage and identified with labels clearly describing contents.

1. Furnish not less than one box for each 50 boxes or fraction thereof, of each class, wearing surface, color, pattern and size of resilient floor tile installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, resilient floor tiles that may be incorporated in the Work include, but are not limited to, the products specified in each Product Data Sheet at end of this Section.

2.2 RESILIENT TILE

A. Vinyl Composition Floor Tile: Products complying with ASTM F 1066, Composition 1 (nonasbestos formulated), and with requirements specified in Vinyl Composition Floor Tile Product Data Sheet at end of this Section.

2.3 INSTALLATION ACCESSORIES

A. Concrete Slab Primer: Nonstaining type as recommended by flooring manufacturer.

B. Trowelable Underlayments and Patching Compounds: Latex-modified, portland-cement-based formulation provided or approved by tile manufacturer for applications indicated.

C. Adhesives (Cements): Water-resistant type recommended by tile manufacturer to suit resilient floor tile products and substrate conditions indicated.

D. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edge of tiles, and in maximum available lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. General: Examine areas where installation of tiles will occur, with Installer present, to verify that substrates and conditions are satisfactory for tile installation and comply with tile manufacturer's requirements and those specified in this Section.

B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:

1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials whose presence would interfere with bonding of adhesive. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by tile manufacturer.
2. Finishes of subfloors comply with tolerances and other requirements specified in Division 3 Section "Cast-In-Place Concrete" for slabs receiving resilient flooring.
3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits of any kind.

C. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with manufacturer's installation specifications to prepare substrates indicated to receive tile.

B. Use trowelable leveling and patching compounds per tile manufacturer's directions to fill cracks, holes, and depressions in substrates.

C. Remove coatings, including curing compounds, and other substances that are incompatible with flooring adhesives and that contain soap, wax, oil, or silicone, by using a terrazzo or concrete grinder, a drum sander, or a polishing machine equipped with a heavy-duty wire brush.

D. Broom or vacuum clean substrates to be covered by tiles immediately before tile installation. Following cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust.

E. Apply concrete slab primer, if recommended by flooring manufacturer, prior to applying adhesive. Apply according to manufacturer's directions.

3.3 INSTALLATION

A. General: Comply with tile manufacturer's installation directions and other requirements indicated that are applicable to each type of tile installation included in Project.

B. Lay out tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths at perimeter that equal less than one-half of a tile. Install tiles square with room axis, unless otherwise indicated.

C. Match tiles for color and pattern by selecting tiles from cartons in same sequence as manufactured and packaged, if so numbered. Cut tiles neatly around all fixtures. Discard broken, cracked, chipped, or deformed tiles.

1. Lay tiles in basket weave pattern with grain direction alternating between reversed in adjacent tiles.

D. Where demountable partitions and other items are indicated for installing on top of finished tile floor, install tile before these items are installed.

E. Scribe, cut, and fit tiles to butt tightly to vertical surfaces, permanent fixtures, built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings.

F. Extend tiles into toe spaces, door reveals, closets, and similar openings.

G. Maintain reference markers, holes, or openings that are in place or plainly marked for future cutting by repeating on finish flooring as marked on subfloor. Use chalk or other nonpermanent marking device.

H. Install tiles on covers for telephone and electrical ducts, and similar items occurring within finished floor areas. Maintain overall continuity of color and pattern with pieces of flooring installed on these covers. Tightly adhere edges to perimeter of floor around covers and to covers.

I. Adhere tiles to flooring substrates without producing open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, or other surface imperfections in completed tile installation.

J. Use full spread of adhesive applied to substrate in compliance with tile manufacturer's directions including those for trowel notching, adhesive mixing, and adhesive open and working times.

K. Hand roll tiles where required by tile manufacturer.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after completing tile installation:

1. Remove visible adhesive and other surface blemishes using cleaner recommended by tile manufacturers.
2. Sweep or vacuum floor thoroughly.
3. Do not wash floor until after time period recommended by resilient floor tile manufacturer.
4. Damp-mop tile to remove black marks and soil.

B. Protect flooring against mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods indicated or recommended by tile manufacturer.

1. Apply protective floor polish to tile surfaces that are free from soil, visible adhesive, and surface blemishes.

a. Use commercially available, metal, cross-linked acrylic product acceptable to tile manufacturer.
b. Coordinate selection of floor polish with Owner's maintenance service.

2. Do not move heavy and sharp objects directly over tiles. Place plywood or hardboard panels over tiles and under objects while they are being moved. Slide or roll objects over panels without moving panels.

C. Clean tiles not more than 4 days prior to dates scheduled for inspections intended to establish date of Substantial Completion in each area of Project. Clean tiles using method recommended by manufacturer.

1. Strip protective floor polish that was applied after completing installation prior to cleaning.
2. Reapply floor polish after cleaning.

VINYL COMPOSITION FLOOR TILE PRODUCT DATA SHEET

Vinyl composition Floor Tile Designation:

Class: Class 2 (through pattern tile)
Wearing Surface: Smooth
Gauge: 1/8”
Size: 12-by12 inches
Color and Pattern: As selected by Owner from manufacturer's full range of colors and patterns produced for tile of class, wearing surface, thickness, size and pattern specified.

Available Products:
Armstrong Flooring
Kentile Floors
Azrock Industries
Mannington Commercial

END OF SECTION 09 66 11

DIVISION 09 00 00: FINISHES
Section 09 72 16: Fiberglass Reinforced Plastic Panels

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Special wall surfaces, including fiberglass reinforced plastic wall panels.

B. Related Sections: Section(s) related to this section include:

1. Gypsum Board Assemblies.

1.02 REFERENCES

A. General: Standards listed by reference, including revisions by issuing authority, form a part of this specification section to extent indicated. Standards listed are identified by issuing authority, authority abbreviation, designation number, title or other designation established by issuing authority. Standards subsequently referenced herein are referred to by issuing authority abbreviation and standard designation.

B. ASTM International:

1. ASTM D2583 Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor.
2. ASTM D5319 Standard Specification for Glass-Fiber Reinforced Polyester Wall and Ceiling Panels.
3. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials.

1.03 SYSTEM DESCRIPTION

A. Performance Requirements: Provide fiberglass reinforced plastic (FRP) panels factory laminated to 5/8” thick water resistant gypsum board which have been manufactured and installed to maintain performance criteria stated by manufacturer without defects, damage or failure.

1.04 SUBMITTALS

A. General: Submit listed submittals in accordance with Conditions of the Contract and Division 1 Submittal Procedures Section.

B. Product Data: Submit product data, including manufacturer’s product sheet, for specified products.

C. Shop Drawings: Submit shop drawings showing layout, profiles and product components, including anchorage, accessories, finish colors, patterns and textures. Indicate location and dimension of joints and fastener attachments.

D. Samples: Submit selection and verification samples for finishes, colors and textures.

1. Submit 3 inch × 3 inch (76 × 76 mm) samples of each surface and color required.
2. Submit 3 inch (76 mm) samples of each trim profile and trim color required.

E. Quality Assurance Submittals: Submit the following:

1. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.
2. Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics, criteria and physical requirements.
3. Manufacturer’s Instructions: Manufacturer’s installation instructions.
4. Manufacturer’s Field Reports: Manufacturer’s field reports specified herein.

F. Closeout Submittals: Submit the following:

1. Operation and Maintenance Data: Operation and maintenance data for installed products in accordance with Division 1 Closeout Submittals (Maintenance Data and Operation Data) Section. Include methods for maintaining installed products and precautions against cleaning materials and methods detrimental to finishes and performance.

2. Warranty: Warranty documents specified herein.

1.05 QUALITY ASSURANCE

A. Qualifications:

1. Installer Qualifications: Installer should be experienced in performing work of this section and should have specialized in installation of work similar to that required for this project.

a. Certificate: When requested, submit certificate indicating qualifications.

2. Manufacturer Qualifications: Manufacturer capable of providing field service representation during construction and capable of approving application method.

B. Mock-Ups: Install at project site a job mock-up using acceptable products and manufacturer approved installation methods. Obtain Owner's and Architect's acceptance of finish color, texture, pattern and workmanship standards. Comply with Division 1 Quality Control (Mock-Up Requirements) Section.

1. Mock-Up Size: 4' x 8'.

2. Maintenance: Maintain mock-up during construction for workmanship comparison; remove and legally dispose of mock-up when it is no longer required.

3. Incorporation: Mock-up may be incorporated into final construction upon Owner's/Architect's approval.

C. Pre-installation Meetings: Conduct pre-installation meeting to verify project requirements, substrate conditions, manufacturer's installation instructions and manufacturer's warranty requirements. Comply with Division 1 Project Management and Coordination (Project Meetings) Section.

1.06 DELIVERY, STORAGE & HANDLING

A. General: Comply with Division 1 Product Requirements Section.

B. Ordering: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.

C. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact. Package sheets on skids or pallets for shipment to project site.

D. Storage and Protection: Store materials protected from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.

1. Store products indoors and protect from moisture, construction traffic and damage.

2. Store panels flat on clean, dry surface. Do not stand on edge or stack on fresh concrete or other surfaces that emit moisture.

3. Store panels at least 24 hours with temperature and humidity conditions approximating the average environment of the finished room.

E. Handling: Remove foreign matter from face of panel by use of a soft bristle brush, avoiding abrasive action.

1.07 PROJECT CONDITIONS

A. Environmental Requirements:

1. Installation shall not begin until building is enclosed, permanent heating and cooling equipment is in operation and residual moisture from plaster, concrete or terrazzo work

has dissipated.

2. During installation and for not less than 48 hours before, maintain an ambient temperature and relative humidity within limits required by type of adhesive used and recommendation of adhesive manufacturer.

3. Provide ventilation to disperse fumes during application of adhesive as recommended by adhesive manufacturer.

B. Field Measurements: Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

1.08 WARRANTY

A. Project Warranty: Refer to Conditions of the Contract for project warranty provisions.

B. Manufacturer's Warranty: Submit, for Owner’s acceptance, manufacturer’s standard warranty document executed by authorized company official. Manufacturer’s warranty is in addition to, and not a limitation of, other rights Owner may have under Contract Documents.

1. Warranty Period: 5 years commencing on Date of Final Completion.

1.09 MAINTENANCE

A. Extra Materials: Deliver to Owner extra materials from same production run as products installed. Package products with protective covering and identify with descriptive labels. Comply with Division 1 Closeout Submittals (Maintenance Materials) Section.

1. Quantity: Furnish quantity of FRP units equal to 5% of amount installed.

2. Delivery, Storage and Protection: Comply with Owner’s requirements for delivery, storage and protection of extra materials.

PART 2 PRODUCTS

2.01 FIBERGLASS REINFORCED PLASTIC (FRP) PANELS

A. Manufacturer: Kemlite Company, Inc. or approved equal.

B. Product(s): LascoLam Flat Fiberglass Reinforced Plastic Composite (FRP) Panels or equal.

1. Description: Composite plastic panels of random chopped fiberglass roving, modified polyester copolymer, inorganic fillers and pigments. Resistant to rot, corrosion, staining, denting, peeling and splintering. Meets USDA requirements. Comply with ASTM D5319, various grades and classifications.

C. Panels:

1. LascoLam Wall Panels; Class A.

D. Panel Size:

1. Wall Panel Width: 48 inches (1.2 m).

2. Wall Panel Length: As indicated on the drawings. Provide full-length panels unless substrate dimensions exceed available fabricated size.

E. Thickness:

1. Standard Panels: Manufacturer’s thickest available fiberglass reinforced panel as recommended for lamination to 5/8” gypsum board.

F. Dimensional Tolerances:

1. Width and Length: 1/8 inch (3.2 mm).

2. Thickness: +/- 10%.

3. Squareness: Not more than 1/8 inch (3.2 mm) out of square.

G. Panel Finish:

1. Exposed Surface: Pebble-like embossed finish.
2. Back Surface: Smooth. Imperfections that do not affect functional properties are not cause for rejection.
3. Color: Uniform throughout. Selected by the Architect from manufacturer's standard range of white, beige, almond, silver, ivory, gray and black.

H. Panel Physical Properties: Provide products with the following properties:

1. Surface Burning Classification: Class A; flamespread (ASTM E84): 25 or less; smoke developed (ASTM E84): 450 or less.
2. Barcol Hardness (ASTM D2583): 25 - 35.
3. Meets USDA requirements.

I. Trim: Provide panel manufacturer's standard vinyl moldings to meet project conditions. Provide division bar, inside corner, outside corner and end cap, etc. as shown on drawings.

1. 0.09 inch (2.3 mm) Contractor Trim: Match panel color.

J. Fasteners: Nonstaining nylon drive rivets; match panel colors and length to suit project conditions.

2.02 ACCESSORY MATERIALS

A. Adhesive: Structural construction adhesive as recommended by adhesive manufacturer.

B. Sealant: Clear silicone sealant as recommended by sealant manufacturer.

2.03 RELATED MATERIALS

A. Related Materials: Refer to other sections listed in Related Sections paragraph herein for related materials.

2.04 SOURCE QUALITY

A. Source Quality: Obtain fiberglass reinforced plastic (FRP) laminated panels from a single manufacturer. Provide panels and molding only from manufacturer specified to ensure warranty and color harmonization of accessories.

PART 3 EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

A. Compliance: Comply with manufacturer's product data, including product technical bulletins, product catalog installation instructions and product carton instructions for installation.

3.02 EXAMINATION

A. Site Verification of Conditions: Verify that substrate conditions, which have been previously installed under other sections, are acceptable for product installation in accordance with manufacturer's instructions.

1. Examine back-up surfaces to determine that corners are plumb and straight, surfaces are smooth, uniform, clean and free from foreign matter, nails are countersunk, and joints and cracks are filled flush and smooth with the adjoining surface.
2. Examine substrates to receive panels to ensure that surfaces are smooth, dry, true and free of dirt and dust.
3. Do not begin installation until back-up surfaces are in a satisfactory condition.

3.03 PREPARATION

A. Surface Preparation: Per manufacturer's written recommendations.

3.04 INSTALLATION

A. Fiberglass Reinforced Panel (FRP) Installation:

1. Cut and drill panels with carbide tipped saw blades or drill bits, or cut with snips.
2. Install panels with manufacturer's recommended gap for panel field and corner joints.
3. Predrill fastener holes in panels with 1/8 inch (3.2 mm) oversize.
4. For trowel type and application of adhesive, follow adhesive manufacturer's recommendations.
5. Using products acceptable to panel manufacturer, install FRP system in accordance with panel manufacturer's printed instructions.

3.05 FIELD QUALITY REQUIREMENTS

A. Manufacturer's Field Services: Upon Owner's request, provide manufacturer's field service consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

3.06 CLEANING

A. Cleaning: Remove temporary coverings and protection of adjacent work areas. Repair or replace damaged installed products. Clean installed products in accordance with manufacturer's instructions prior to Owner's acceptance. Remove construction debris from project site and legally dispose of debris.

1. Remove any adhesive or excessive sealant from panel face using solvent or cleaner recommended by panel manufacturer.
2. Remove scraps and debris from the site, and leave in a neat and clean condition.

3.07 PROTECTION

A. Protection: Protect installed product and finished surfaces from damage during construction and until Final Acceptance.

END OF SECTION 09 72 16

DIVISION 09 00 00: FINISHES
Section 09 91 00: Painting

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Surface preparation and field painting of exposed interior items and surfaces.

B. Surface preparation and field painting of exposed exterior items and surfaces.

C. Surface preparation and field application of interior high-performance coating systems to items and surfaces scheduled.

D. Painting of exposed bare and covered pipes and ducts, hangers, exposed steel and iron supports, and surfaces of mechanical and electrical equipment that do not have a factory-applied final finish.

1.2 RELATED SECTIONS

A. Metal Fabrications: Shop priming ferrous metal.

B. Steel Doors and Frames: Factory priming steel doors and frames.

C. Gypsum Board Assemblies: Surface preparation of gypsum board.

D. Basic Mechanical Materials and Methods: Mechanical identification.

E. Basic Electrical Materials and Methods: Mechanical identification.

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM) D 16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications.

B. Steel Structures Painting Council (SSPC) SP6 - Commercial Blast Cleaning Procedures.

C. Steel Structures Painting Council (SSPC) SP10 - Near White Blast Cleaning Procedure.

1.4 DEFINITIONS

A. General: Standard coating terms defined in ASTM D 16.
   1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.
   2. Eggshell refers to low-sheen finish with a gloss range between 20 and 35 when measured at a 60-degree meter.
   3. Semigloss refers to medium-sheen finish with a gloss range between 35 and 70 when measured at a 60-degree meter.
   4. Full gloss refers to high-sheen finish with a gloss range more than 70 when measured at a 60-degree meter.

B. Environments: The following terms distinguish between different corrosive exposures:
   1. "Severe environments" are highly corrosive industrial atmospheres with sustained exposure to high humidity and condensation and with frequent cleaning using strong chemicals. Environments with heavy concentrations of strong chemical fumes and frequent splashing and spilling of harsh chemical products are severe environments.
   2. "Moderate environments" are corrosive industrial atmospheres with intermittent

exposure to high humidity and condensation, occasional mold and mildew development, and regular cleaning with strong chemicals. Environments with exposure to heavy concentrations of chemical fumes and occasional splashing and spilling of chemical products are moderate environments.

3. "Mild environments" are industrial atmospheres with normal exposure to moderate humidity and condensation, occasional mold and mildew development, and infrequent cleaning with strong chemicals. Environments with low levels of mild chemical fumes and occasional splashing and spilling of chemical products are mild environments. Normal outdoor weathering is also considered a mild environment.

1.5 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Product Data: For each paint system indicated, including:
   1. Material List: An inclusive list of required coating materials. Indicate each material and cross reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
   2. Preparation instructions and recommendations.
   3. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material.

C. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

D. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

B. Obtain block fillers and primers for each coating system from the same manufacturer as the finish coats.

C. Paint exposed surfaces. If an item or a surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces. If a color of finish is not indicated, Architect will select from standard colors and finishes available.

D. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.

E. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
   1. Finish areas designated by Architect.
   2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
   3. Refinish mock-up area as required to produce acceptable work.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label:

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F (7 deg C). Maintain storage containers in a clean condition, free of foreign materials and residue.

1.8 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

B. Apply waterborne paints only when temperatures of surfaces to be painted and surrounding air are between 50 and 90 deg F (10 and 32 deg C).

C. Apply solvent-thinned paints only when temperatures of surfaces to be painted and surrounding air are between 45 and 95 deg F (7 and 35 deg C).

D. Do not apply paint in snow, rain, fog, or mist; or when relative humidity exceeds 85 percent; or at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.
   1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

1.9 EXTRA MATERIALS

A. Furnish extra paint materials from the same production run as the materials applied and in the quantities described below. Package with protective covering for storage and identify with labels describing contents. Deliver extra materials to Owner.

B. Quantity: Furnish Owner with an additional three percent, but not less than 1 gal (3.8 l) or 1 case, as appropriate, of each material and color applied.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: PPG Architectural Finishes, Inc. - Pittsburgh Paints (basis of design) and equal products by Sherwin-Williams and Devoe.

B. Requests for substitutions will be considered in accordance with provisions of Section 01600.

2.2 PAINT MATERIALS - GENERAL

A. Material Compatibility: Provide block fillers, primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. VOC Classification: Provide high-performance coating materials, including primers, undercoats, and finish-coat materials, that have a VOC classification of 450 g/l or less.

C. Colors shall be selected by the Architect from the coating manufacturer’s full palette range.

2.3 EXTERIOR PAINT SYSTEMS

A. Ferrous Metal: Provide the following finish systems over exterior ferrous metal. Primer is

not required on shop-primed items.

1. Acrylic-Enamel Finish: Two finish coats over a rust-inhibitive primer (primer required for items not shop-primed).
   a. Primer for Items Not Shop-Primed: Pittsburgh Paints; 90-712 Pitt-Tech One Pack Interior/Exterior Primer Finish DTM Industrial Enamel: Applied at a dry film thickness of not less than 3.0 mils (0.076 mm).
   b. Exterior Semi-gloss acrylic enamel finish: Pittsburgh Paints; 90-1210 Series Pitt-Tech Plus Interior/Exterior Semi-gloss DTM Industrial Enamel: Applied at a dry film thickness of not less than 2.0 mils (0.050 mm).

2.4 INTERIOR PAINT SYSTEMS

A. Gypsum Board: Provide the following finish systems over interior gypsum board surfaces:
   1. Acrylic Finish: Two finish coats over a primer.
      a. Primer-Zero VOC: Pittsburgh Paints; 9-900 Pure Performance Interior Latex Primer: Applied at a dry film thickness of not less than 1.4 mils (0.035 mm).
      b. Interior semigloss acrylic enamel-Zero VOC: Pittsburgh Paints; 9-500 Series Pure Performance Interior Semigloss Latex: Applied at a dry film thickness of not less than 1.7 mils (0.043 mm).

B. Ferrous Metal: Provide the following finish systems over ferrous metal:
   1. Acrylic Finish: Two finish coats over a primer.
      a. Primer: Pittsburgh Paints; 90-712 Pitt-Tech One Pack Interior/Exterior Primer/Finish DTM Industrial Enamel: Applied at a dry film thickness of not less than 2.0 mils (0.051 mm).
      b. Interior semigloss acrylic enamel-Zero VOC: Pittsburgh Paints; 9-500 Series Pure Performance Interior Semigloss Latex: Applied at a dry film thickness of not less than 1.7 mils (0.043 mm).

2.5 INTERIOR HIGH PERFORMANCE COATING SYSTEMS

A. Gypsum Board: Provide the following finish systems over interior gypsum board:
   1. Severe Environment (High-Gloss Finish): One finish coat over an intermediate coat manufacturer recommended primer for gypsum board.
      a. Use manufacturer recommended primer for gypsum board.
      b. Intermediate Coat: Epoxy applied at spreading rate recommended by manufacturer to achieve a dry film thickness of 2.0 to 3.0 mils
         1) PPG: 95-1 Series Aquapon 35 Gloss Polyamide-Epoxy Coating.
      c. Topcoat: High-gloss epoxy applied at spreading rate recommended by manufacturer to achieve a dry film thickness of 2.0 to 3.0 mils
         1) PPG: 95-1 Series Aquapon 35 Gloss Polyamide-Epoxy Coating.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
   1. Notify Architect about anticipated problems when using the materials specified over

substrates primed by others.

2. If a potential incompatibility of primers applied by others exists, obtain the following from the primer Applicator before proceeding:
   a. Confirmation of primer's suitability for expected service conditions.
   b. Confirmation of primer's ability to be top coated with materials specified.

3.2 PREPARATION

A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of size or weight of the item, provide surface-applied protection before surface preparation and painting.
   1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

B. Cleaning: Before applying paint or other surface treatments, clean substrates of substances that could impair bond of the various coatings. Remove oil and grease before cleaning.
   1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.
   1. Provide barrier coats over incompatible primers or remove and reprime.
   2. Provide barrier coats over incompatible primers or remove primers and reprime substrate.
   3. Cementitious Substrates: Prepare concrete, brick, concrete masonry block, and cement plaster surfaces to be coated. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods to prepare surfaces.
      a. Use abrasive blast-cleaning methods if recommended by coating manufacturer.
      b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not coat surfaces if moisture content exceeds that permitted in manufacturer's written instructions.
   4. Ferrous Metal Substrates: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC recommendations.
      a. Blast-clean steel surfaces as recommended by coating manufacturer and according to SSPC-SP 10.
      b. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
      c. Touch up bare areas and shop-applied prime coats that have been damaged. Wire brush, solvent clean, and touch up with same primer as the shop coat.

D. Material Preparation: Carefully mix and prepare coating materials according to manufacturer's written instructions.
   1. Maintain containers used in mixing and applying coatings in a clean condition, free of foreign materials and residue.
   2. Stir materials before applying to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into the material. Remove film and, if necessary, strain coating material before using.
   3. Use only the type of thinners approved by manufacturer and only within recommended limits.

4. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.3 APPLICATION

A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.

B. General: Apply high-performance coatings according to manufacturer's written instructions.
1. Use applicators and techniques best suited for the material being applied.
2. Do not apply high-performance coatings over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to forming a durable coating film.
3. Coating surface treatments, and finishes are indicated in the coating system descriptions.
4. Provide finish coats compatible with primers used.
5. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convector covers, grilles, covers for finned-tube radiation, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.

C. Application Procedures: Apply coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.
1. The number of coats and film thickness required is the same regardless of application method.
2. Completed Work: Match approved Samples for color, texture, and coverage. Remove, refinish, or recoat work that does not comply with specified requirements.

3.4 FIELD QUALITY CONTROL

A. Owner reserves the right to invoke the following test procedure at any time and as often as Owner deems necessary during the period when paint is being applied:
1. Owner will engage a qualified independent testing agency to sample paint material being used. Samples of material delivered to Project will be taken, identified, sealed, and certified in the presence of Contractor.
2. Owner may direct Contractor to stop painting if test results show material being used does not comply with specified requirements. Contractor shall remove noncomplying paint from Project site, pay for testing, and repaint surfaces previously coated with the noncomplying paint. If necessary, Contractor may be required to remove noncomplying paint from previously painted surfaces if, on repainting with specified paint, the two coatings are incompatible.

3.5 CLEANING

A. After completing painting, clean glass and paint spattered surfaces. Remove spattered paint by washing and scraping without scratching or damaging adjacent finished surfaces.

3.6 PROTECTION

A. Protect work of other trades, whether being painted or not, against damage from painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.

B. Provide "Wet Paint" signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work.

C. After work of other trades is complete, touch up and restore damaged or defaced painted surfaces.

END OF SECTION 09 91 00

DIVISION 9: FINISHES
Section 09 92 00: Elastomeric Coating

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Surface preparation and field painting of exposed exterior cast-in-place concrete and concrete unit masonry surfaces.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM) D 16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications.

1.3 DEFINITIONS

A. General: Standard coating terms defined in ASTM D 16.
   1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.
   2. Eggshell refers to low-sheen finish with a gloss range between 20 and 35 when measured at a 60-degree meter.
   3. Semi-gloss refers to medium-sheen finish with a gloss range between 35 and 70 when measured at a 60-degree meter.
   4. Full gloss refers to high-sheen finish with a gloss range more than 70 when measured at a 60-degree meter.

1.4 SUBMITTALS

A. Submit under provisions of Section 01300.

B. For each paint system indicated, including:
   1. Material List: An inclusive list of required coating materials. Indicate each material and cross reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
   2. Preparation instructions and recommendations.
   3. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material.

C. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

D. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

B. Obtain primers for each coating system from the same manufacturer as the finish coats.

C. Paint exposed surfaces. If an item or a surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces. If a color or finish is not indicated, Architect will select from standard colors and finishes available.

D. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.

E. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
   1. Finish areas designated by Architect.
   2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
   3. Refinish mock-up area as required to produce acceptable work.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label:

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F (7 deg C). Maintain storage containers in a clean condition, free of foreign materials and residue.

1.7 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

B. Apply waterborne paints only when temperatures of surfaces to be painted and surrounding air are between 50 and 90 deg F (10 and 32 deg C).

C. Apply solvent-thinned paints only when temperatures of surfaces to be painted and surrounding air are between 45 and 95 deg F (7 and 35 deg C).

D. Do not apply paint in snow, rain, fog, or mist; or when relative humidity exceeds 85 percent; or at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.
   1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

1.8 EXTRA MATERIALS

A. Furnish extra paint materials from the same production run as the materials applied and in the quantities described below. Package with protective covering for storage and identify with labels describing contents. Deliver extra materials to Owner.

B. Quantity: Furnish Owner with an additional three percent, but not less than 1 gal (3.8 l) or 1 case, as appropriate, of each material and color applied.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: PPG Architectural Finishes, Inc. (basis of design); Benjamin Moore; Pratt & Lambert.

B. Requests for substitutions will be considered in accordance with provisions of Division 1.

2.2 PAINT MATERIALS - GENERAL

A. Material Compatibility: Provide primers and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. VOC Classification: Provide high-performance coating materials, including primers, undercoats, and finish-coat materials, that have a VOC classification of 450 g/l or less.

C. Color: Shall be selected by the Architect.

2.3 EXTERIOR PAINT SYSTEMS

A. Concrete and Concrete Unit Masonry: Provide the following finish systems over exterior concrete and concrete unit masonry substrates:
   1. Acrylic Finish: Two finish coats over a primer.
      a. Primer: Pittsburgh Paints: 4-603 Perma-Crete Interior/Exterior Alkali Resistant Primer. Applied at a dry film thickness of not less than 1.2 mils (0.030 mm).
      b. Exterior elastomeric coating: Pittsburgh Paints; 4-110 Perma-Crete Pitt-Flex Elastomeric Coating: Applied at a dry film thickness of not less than 5.4 mils (0.136 mm).

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
   1. Notify Architect about anticipated problems when using the materials specified over substrates primed by others.
   2. If a potential incompatibility of primers applied by others exists, obtain the following from the primer Applicator before proceeding:
      a. Confirmation of primer's suitability for expected service conditions.
      b. Confirmation of primer's ability to be top coated with materials specified.

3.2 PREPARATION

A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of size or weight of the item, provide surface-applied protection before surface preparation and painting.
   1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

B. Cleaning: Before applying paint or other surface treatments, clean substrates of substances that could impair bond of the various coatings. Remove oil and grease before cleaning.
   1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.
   1. Provide barrier coats over incompatible primers or remove and re-prime.
   2. Provide barrier coats over incompatible primers or remove primers and re-prime

substrate.

3. Cementitious Substrates: Prepare concrete surfaces to be coated. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods to prepare surfaces.
   a. Use abrasive blast-cleaning methods if recommended by coating manufacturer.
   b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not coat surfaces if moisture content exceeds that permitted in manufacturer's written instructions.

D. Material Preparation: Carefully mix and prepare coating materials according to manufacturer's written instructions.
   1. Maintain containers used in mixing and applying coatings in a clean condition, free of foreign materials and residue.
   2. Stir materials before applying to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into the material. Remove film and, if necessary, strain coating material before using.
   3. Use only the type of thinners approved by manufacturer and only within recommended limits.
   4. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.3 APPLICATION

A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.

B. Application Procedures: Apply coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.
   1. The number of coats and film thickness required is the same regardless of application method.
   2. Completed Work: Match approved Samples for color, texture, and coverage. Remove, refinish, or recoat work that does not comply with specified requirements.

3.4 FIELD QUALITY CONTROL

A. Owner reserves the right to invoke the following test procedure at any time and as often as Owner deems necessary during the period when paint is being applied:
   1. Owner will engage a qualified independent testing agency to sample paint material being used. Samples of material delivered to Project will be taken, identified, sealed, and certified in the presence of Contractor.
   2. Owner may direct Contractor to stop painting if test results show material being used does not comply with specified requirements. Contractor shall remove non-complying paint from Project site, pay for testing, and repaint surfaces previously coated with the non-complying paint. If necessary, Contractor may be required to remove non-complying paint from previously painted surfaces if, on repainting with specified paint, the two coatings are incompatible.

3.5 CLEANING

A. After completing painting, clean glass and paint spattered surfaces. Remove spattered paint by washing and scraping without scratching or damaging adjacent finished surfaces.

3.6 PROTECTION

A. Protect work of other trades, whether being painted or not, against damage from painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.

B. Provide "Wet Paint" signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work.

C. After work of other trades is complete, touch up and restore damaged or defaced painted surfaces.

END OF SECTION

DIVISION 10 00 00: SPECIALTIES
Section 10 14 15: Signage

PART 1 GENERAL

1.1 REFERENCES

A. Americans with Disabilities Act (ADA).

B. American National Standards Institute (ANSI):
   1. ANSI A117.1 - Accessible and Usable Buildings and Facilities Standards.

1.2 SUBMITTALS

A. Submit per specifications requirements.

B. Product Data: Manufacturer's data sheets on each product to be installed.

C. Shop Drawings: Shop drawings with letter style, general layout for each sign type, with sizes, edge and corner treatment, and mounting methods shown.

D. Selection Samples: For each finish specified, two complete sets of color chips representing manufacturer's full range of available colors, patterns and finishes.

E. Verification Samples: For each finish product specified, one full-size sign representing actual product, color, patterns, and finishes. Include method of raised symbols and copy.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer shall have five years experience manufacturing and fabricating products of similar type and scope as those specified in this section.

B. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
   1. Finish areas designated by Architect.
   2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
   3. Refinish mock-up area as required to produce acceptable work.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer's recommendations for delivery, storage and handling.

B. Materials shall be delivered to the location in unopened, labeled factory containers. Upon delivery, materials shall be inspected for damage. Deficient materials shall not be used.

1.5 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Interior Signage : Acceptable Manufacturer:; Best Sign Systems, Inc. , HC300 , (Basis of Design) , Corpus Christi Stamp Works Inc. DBA/ National Signage Affiliates (800-322-4515), APCO Signs or prior approved equivalent.

1. Plaque material shall consist of melamine plastic laminate, approximately 1/8" thick (1/4"thick for slot signs), with background painted a contrasting color and rated non-static,fire-retardant and self-extinguishing. Plastic laminate will be impervious to most acids,alkalies, alcohol, solvents, abrasives and boiling water.

2. Lettering style shall be Standard Medium, upper case, or other sans serif or simple serif typeface.

3. Sizes of letters and numbers shall be as follows:

   Room numbers shall be 5/8" high.

   Lettering for room usage and directional identification shall be 5/8" high.

   Lettering for restroom identification shall be 5/8" high, corresponding symbols shall be 3" high.

   Letters and numbers shall be centered on sign.

   Grade 2 braille shall be placed directly below last line of letters or numbers, except for room number signs, where they shall be placed directly behind the last number.

   Radius corners: 1/2".

B. Requests for substitutions will be considered in accordance with provisions of Section 01600.

2.2 EXTERIOR SIGNAGE

A. Exterior Signs: Post and Panel type, Howard Industries (Basis of Design) or approved equivalent.
   1. Material: .080 inch (2 mm) Aluminum.
   2. Graphics: As indicated on Drawings (reflective).
   3. Howard Industries, HED-100 Sign System, Double Face, Non-Illuminated, Standard Painted Finish.

B. Applied Vinyl Lettering and Markings Exterior Professional Grade UV Resistant / Stable Anti Fade Vinyl Graphic Lettering, Custom Text and Markings as indicated. Colors as indicated and available from Manufacturers Full Range of Standard and Special Colors. 6 mil thickness.

2.3 CAST METAL PLAQUES

A. Plaques: Castings shall be free from pits, scale, sand holes, or other defects. Comply with requirements specified for metal, border style, background texture, and finish and with

requirements shown for thickness, size, shape, and copy. Hand-tool and buff borders and raised copy to produce the manufacturer's standard satin polished finish. Refer to "Finish" article for other finish requirements.

1. Metal: Aluminum.
2. Border Style: Raised flat band.
3. Background Texture: Manufacturer's standard leatherette finish.
4. Background Finish: Provide the manufacturer's standard baked enamel finish.
5. Size: 24" x 36"

PART 3 EXECUTION

3.1 EXAMINATION

A. Inspect conditions of substrate and other conditions which may affect installation of signage.

B. Do not begin installation until substrates are within manufacturer's specified tolerances and have been prepared in accordance with manufacturer's instructions.

C. If substrate preparation is the responsibility of another installer, do not proceed with installation. Notify Architect of unsatisfactory preparation immediately.

D. Commencement of work is deemed as acceptance of installation conditions.

3.2 PREPARATION

A. Verify mounting heights and locations for signage will comply with specified requirements, including accessibility requirements.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions. Clean mounting locations of dirt, dust, grease or similar conditions that would prevent proper installation.

3.3 INSTALLATION

A. Install in accordance with manufacturer's printed installation instructions, and in proper relationship with adjacent work.

3.4 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Final Acceptance.

END OF SECTION 10 14 15

DIVISION 10: SPECIALTIES
Section 10 20 00: Louvers and Vents

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and any general provisions of the Contract for all Bid Items, including General and Supplementary Conditions and Program Manager's specific requirements apply to this section.

1.2 SUMMARY

A. This Section includes the following:

1. Fixed metal wall louvers. (See Mechanical and Architectural Louver Schedules. Cross reference these schedules for full scope of this Item).
2. Wall vents (brick vents).

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 7 Section "Joint Sealants" for sealants installed in perimeter joints between louver frames and adjoining construction.
2. Division 8 Section "Standard Steel Doors and Frames" for louvers in hollow metal doors and frames.
3. Division 8 Section "Flush Wood Doors" for louvers in wood doors.
4. Division 9 Section "Painting" for field painting louvers.
5. Division 15 Section "Metal Ductwork" for ductwork connected to metal wall louvers.

1.3 DEFINITIONS

A. Louver Terminology: Refer to Air Movement and Control Association (AMCA) 501 for definitions of terms for metal louvers not otherwise defined in this Section or in referenced standards.

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance: Engineer, fabricate, and install exterior metal wall louvers to withstand the effects of loads and stresses from wind and normal thermal movement without evidencing permanent deformation of louver components including blades, frames, and supports; noise or metal fatigue caused by louver blade rattle or flutter; or permanent damage to fasteners and anchors.

1. Wind Load: Uniform pressure (velocity pressure) of 20 lbf per sq. ft. (960 Pa), acting inwards or outwards.
2. Normal thermal movement is defined as that resulting from the following maximum change (range) in ambient temperature. Base design calculations on actual surface temperatures of metals due to both solar heat gain and nighttime sky heat loss.

a. Temperature Change (Range): 100 deg F (56 deg C).

B. Air-Performance, Water-Penetration, and Air-Leakage Ratings: Provide louvers complying with performance requirements indicated as demonstrated by testing manufacturer's stock units of height and width indicated. Test units according to AMCA 500.

1. Perform testing on unpainted, cleaned, degreased units.
2. Perform water-penetration testing on louvers without screens.
3. Equivalent Air-Performance Ratings: Louvers having less free area than that specified or having a lower free area velocity at the static pressure loss specified may be considered for the Work provided their total air performance is equivalent to that specified. The burden of proof of equivalency is on the Contractor. For louvers to be considered equivalent, the product of their free area, for the size specified, and their free area velocity at the static pressure loss specified must be at least equal to the product of the specified free area and velocity. Also, their free area velocity at the static pressure loss specified must not result in water penetration of more than 0.01 oz. per sq. ft. (3.1 g/sq. m) of free area, and they must meet all other requirements.

1.5 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract.

B. Product data for each type of product specified.

C. Shop drawings of louver units and accessories. Include plans, elevations, sections, and details showing profiles, angles, and spacing of louver blades; unit dimensions related to wall openings and construction; free areas for each size indicated; profiles of frames at jambs, heads, and sills; and anchorage details and locations.

1. For installed products indicated to comply with certain design loadings, include structural analysis data sealed and signed by the qualified professional engineer who was responsible for their preparation.

D. Samples for initial selection in the form of manufacturer's color charts showing the full range of colors available for units with factory-applied color finishes.

E. Samples for verification of each type of metal finish required, prepared on samples of same thickness and material indicated for final unit of Work. Where finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.

F. Product test reports evidencing compliance of units with performance requirements indicated.

G. Product certificates signed by louver manufacturers certifying that their products comply with the specified requirements and are licensed to bear the AMCA seal based on tests made according to AMCA 500 and complying with the AMCA Certified Ratings Program.

H. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience.

1.6 QUALITY ASSURANCE

A. Single-Source Responsibility: Obtain louvers and vents from one source and by a single manufacturer where alike in one or more respects regarding type, design, and factory-applied color finish.

B. Welding Standards: Comply with applicable provisions of D1.2 "Structural Welding Code--Aluminum," and D1.3 "Structural Welding Code--Sheet Steel."

C. Engineer Qualifications: A professional engineer legally authorized to practice in the jurisdiction where the Project is located and experienced in providing engineering services of the kind indicated that have resulted in the installation of louvers similar to this Project in material, design, and extent and that have a record of successful in-service performance.

D. SMACNA Standard: Comply with SMACNA "Architectural Sheet Metal Manual" recommendations for fabrication, construction details, and installation procedures.

1.7 PROJECT CONDITIONS

A. Field Measurements: Check actual louver openings by accurate field measurements before fabrication, and show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Where field measurements cannot be made without delaying the Work, guarantee opening dimensions and proceed with fabricating louvers without field measurements. Coordinate construction to ensure that actual opening dimensions correspond to guaranteed dimensions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

1. Louvers:

a. Airline Products Co.
b. Airolite Co.
c. Airstream Products Div., Penn Ventilator Co., Inc.
d. All-Lite Louver Co.
e. American Warming and Ventilating, Inc.
f. Arrow United Industries.
g. Construction Specialties, Inc.
h. Greenheck Fan Corp.
i. Industrial Louvers, Inc.
j. Reliable Metal Products, Div. of Hart & Cooley, Inc.
k. Ruskin Mfg., Tomkins Industries, Inc.

2. Metal Wall Vents and Soffit vents:

a. Airline Products Co.
b. Airolite Co.
c. Airstream Products Div., Penn Ventilator Co., Inc.
d. All-Lite Louver Co.
e. American Warming and Ventilating, Inc.
f. Arrow United Industries.
g. Construction Specialties, Inc.
h. Greenheck Fan Corp.
i. Industrial Louvers, Inc.
j. Reliable Metal Products, Div. of Hart & Cooley, Inc.

k. Riesner Vent Brick Corp.
l. Ruskin Mfg., Tomkins Industries, Inc.
m. Sunvent Industries, Sylro Sales Corp.

2.2 MATERIALS

A. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T5 or T-52.

B. Fasteners: Of same basic metal and alloy as fastened metal or 300 series stainless steel, unless otherwise indicated. Do not use metals that are corrosive or incompatible with joined materials.

1. Use types and sizes to suit unit installation conditions.
2. Use Phillips flat-head screws for exposed fasteners, unless otherwise indicated.

C. Anchors and Inserts: Of type, size, and material required for type of loading and installation indicated. Use nonferrous metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or expansion bolt devices for drilled-in-place anchors.

2.3 FABRICATION, GENERAL

A. General: Fabricate louvers and vents to comply with requirements indicated for design, dimensions, materials, joinery, and performance.

B. Assemble louvers in shop to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

C. Maintain equal louver blade spacing to produce uniform appearance.

D. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances of louvers, adjoining construction, and perimeter sealant joints.

E. Include supports, anchorages, and accessories required for complete assembly.

F. Provide sill extensions and loose sills made of same material as louvers where indicated or required for drainage to exterior and to prevent water penetrating to interior.

G. Join frame members to one another and to fixed louver blades as follows, unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary:

1. With fillet welds, concealed from view; or mechanical fasteners; or a combination of these methods; as standard with louver manufacturer.

2.4 FIXED, EXTRUDED-ALUMINUM WALL LOUVERS

A. Horizontal, Drainable, Fixed-Blade Louvers: Extruded-aluminum frames and louver blades, designed to collect and drain water to exterior at sill by means of gutters in front edges of blades and channels in jambs and mullions, complying with the following requirements:

1. Louver Depth: 4 inches (100 mm), unless otherwise indicated.

2. Frame Thickness: 0.125 inch (3.18 mm), unless otherwise indicated.
3. Blade Thickness: 0.125 inch (3.18 mm), unless otherwise indicated.
4. Blade Angle: 45 degrees, unless otherwise indicated.
5. Performance Requirements: As follows, determined by testing units 48 inches (1220 mm) wide by 48 inches (1220 mm) high per AMCA 500:

    a. Free Area: Not less than 7.50 sq. ft. (0.697 sq. m).
    b. Static Pressure Loss: Not more than 0.14 inch wg (35 Pa) at an airflow of 900 fpm (4.57 m/s) free area intake velocity.
    c. Water Penetration: Not more than 0.01 oz. per sq. ft. (3.1 g/sq. m) of free area at an airflow of 900 fpm (4.57 m/s) free area velocity when tested for 15 minutes.

6. AMCA Seal: Mark units with the AMCA Certified Ratings Seal.

2.5 WALL VENTS (BRICK VENTS)

A. Extruded-Aluminum Wall Vents: Extruded-aluminum louvers and frames not less than 0.125 inch (3.18 mm) thick and assembled by welding; with 18-by-14 (1.4-by-1.8-mm) mesh aluminum insect screening on inside face; incorporating weepholes, continuous drip at sill, and integral waterstop on inside edge of sill; of load-bearing design and construction. Color shall match color of wall system in which it is installed.

2.6 FINISHES, GENERAL

A. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to applying and designating finishes.

B. Louvers shall receive Kynar 500 finish color coating applied following thorough cleaning and pretreatment. Kynar Finish color shall match adjacent material as selected by Architect and confirmed on submittals. Cleaning includes complete submersion in alkali cleaner, detergent deoxidation, amorphous chrome phosphate conversion coating and acidulated final rinse.

C. Kynar, or equal, shall be applied to provide approximately 1.2 mils (.03) total dry thickness when baked at 450ºF (232º C) for 10 minutes. The finish coating shall meet or exceed AAMA specification 2605 “Voluntary Specification for High Performance Organic Coatings on Architectural Extrusions and Panels.” Colors shall be as selected from full range of manufacturer’s standard colors and shall closely match and compliment colors of wall materials into which louvers are installed.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.2 INSTALLATION

A. Locate and place louver units plumb, level, and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

C. Form closely fitted joints with exposed connections accurately located and secured.

D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

E. Repair finishes damaged by cutting, welding, soldering, and grinding operations required for fitting and jointing. Restore finishes so there is no evidence of corrective work. Return items that cannot be refinished in the field to the shop, make required alterations, and refinish entire unit, or provide new units.

F. Install concealed gaskets, flashings, joint fillers, and insulation, as louver installation progresses, where required to make louver joints weathertight. Comply with Division 7 Section "Joint Sealants" for sealants applied during installation of louver.

3.3 ADJUSTING AND PROTECTION

A. Protect louvers and vents from damage of any kind during construction period including use of temporary protective coverings where needed and approved by louver manufacturer. Remove protective covering at time of Substantial Completion.

B. Restore louvers and vents damaged during installation and construction period, so that no evidence remains of correction work. If results of restoration are unsuccessful, as judged by Architect, remove damaged units and replace with new units.

1. Clean and touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

3.4 CLEANING

A. Periodically clean exposed surfaces of louvers and vents that are not protected by temporary covering to remove fingerprints and soil during construction period. Do not let soil accumulate until final cleaning.

B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Rinse surfaces thoroughly and dry.

END OF SECTION 10 20 00

DIVISION 10: SPECIALTIES
SECTION 10 21 60: SHOWER AND BATH ENCLOSURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Shower door system:
   1. Pivot shower doors.

B. Frameless shower system.

1.2 RELATED SECTIONS

A. Section 06 10 00 - Rough Carpentry: Wood blocking and fasteners for accessory items.

B. Section 09 30 00 - Tile: Drilling and installation of penetrating items.

1.3 REFERENCES

A. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1.4 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

C. Shop Drawings: Include details of construction and relationship with adjacent construction.

D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

E. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square representing actual product, color, and patterns.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Minimum 5 year experience manufacturing similar products.

B. Installer Qualifications: Minimum 2 year experience installing similar products.

C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
   1. Finish areas designated by Architect.
   2. Do not proceed with remaining work until workmanship is approved by Architect.
   3. Refinish mock-up area as required to produce acceptable work.

1.6 PRE-INSTALLATION MEETINGS

A. Convene minimum two weeks prior to starting work of this section.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store products in manufacturer's unopened packaging bearing the brand name and manufacturer's identification until ready for installation.

B. Handling: Handle materials to avoid damage.

1.8 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.9 SEQUENCING

A. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.10 WARRANTY

A. Frameless Showers, Pivot Shower Doors, Sliding Shower Doors: Manufacturer warrants that for a period of three years following the date of sale to customer, the frameless shower door hinges and shower enclosures are warranted against material defects and defects in workmanship. All warranty claims are subject to inspection by manufacturer prior to providing a remedy for the warranty claim.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Morse Industries (Basis of Design or approved equivalent), which is located at: 25811 74th Ave. S.; Kent, WA 98032; Toll Free Tel: 800-325-7513; Tel: 253-852-1399; Fax: 800-411-8226; Email:request info (info@morseindustries.com); Web:www.morseindustries.com

B. Requests for substitutions will be considered in accordance with provisions of Section 01600.

2.2 SHOWER DOOR SYSTEM

A. Pivot Shower Doors:
1. Product: Cascade Pivot Door Design by Morse Industries.
2. Shower Application: 27 inches (686 mm to 60 inches (1524 mm) by 72 inches (1829 mm) height.
3. Glass: Door Panel - 1/4 inch (6.4 mm) tempered safety glass.
4. Glass: Fixed Panel - 3/16 inch (4.8 mm) tempered safety glass.
5. Glass Finish: Clear.
6. Finish: Brushed nickel.
7. Construction: Full length magnetic strike. Vinyl drip deflector. Hardware mounted through glass (no clamped or glued components).

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions, approved submittals, and in proper relationship with adjacent construction.

3.4 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Final Acceptance.

END OF SECTION

DIVISION 10: SPECIALTIES
Section 10 28 00: Toilet and Bath Accessories

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and any general provisions of the Contract for all Bid Items, including General and Supplementary Conditions and Program Manager's specific requirements apply to this section.

1.2 SUMMARY

A. This Section includes standard toilet and bath accessory items as scheduled.

B. Ceramic tile accessories are specified in Division 9.

C. Toilet compartments and related accessories are specified in Division 10.

D. Security Toilet and Bath Accessories are specified in Division 11, Section 11010.

1.3 SUBMITTALS

A. General: Submit the following according to Specific Conditions of the General Contractor.

B. Product data for each toilet accessory item specified, including construction details relative to materials, dimensions, gages, profiles, mounting method, specified options, and finishes.

C. Samples of each toilet accessory item to verify design, operation, and finish requirements. Acceptable full-size samples will be returned and may be used in the Work.

D. Schedule indicating types, quantities, sizes, and installation locations (by room) for each toilet accessory item to be provided for project.

E. Setting drawings where cutouts are required in other work, including templates, substrate preparation instructions, and directions for preparing cutouts and installing anchorage devices.

F. Maintenance instructions including replaceable parts and service recommendations.

1.4 QUALITY ASSURANCE

A. Single-Source Responsibility: Provide products of same manufacturer for each type of accessory unit and for units exposed to view in same areas, unless otherwise acceptable to Architect.

1.5 PROJECT CONDITIONS

A. Coordination: Coordinate accessory locations, installation, and sequencing with other work to avoid interference with and ensure proper installation, operation, adjustment, cleaning,

and servicing of toilet accessory items.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Stainless Steel: AISI Type 302/304, with polished No. 4 finish, 0.034-inch (22-gage) minimum thickness.

B. Mirror Glass: Nominal 6.0-mm (0.23-inch) thick, conforming to ASTM C 1036, Type I, Class 1, Quality q2, and with silvering, electro-plated copper coating, and protective organic coating.

C. Galvanized Steel Mounting Devices: ASTM A 153, hot-dip galvanized after fabrication.

D. Fasteners: Screws, bolts, and other devices of same material as accessory unit, or of galvanized steel where concealed.

E. Keys: Unless otherwise indicated, provide universal keys for access to toilet accessory, units requiring internal access for servicing, resupply, etc. Provide minimum of six (6) keys to Owner's representative and obtain receipt.

2.2 ACCESSORIES

A. Toilet/bath accessories except for detention type, shall be installed where shown on drawings and shall equal Bobrick, Bradley or American Dispenser co. Furnish and install the following or equal. Model No's unless otherwise shown are Bobrick. All are stainless steel unless otherwise shown. Item nos. indicated correspond with item nos. shown on accessory schedule on drawings. See attached Accessory Schedules.

1. 24” Satin Nickel Towel Bar – allen + roth , Jordan 24in Brushed Nickel Wall Mount Single Tower Bar , Model #FSI 657-24 BNIC, Basis of Design or prior approved equivalent.
2. Towel / Robe Hook – allen + roth, Jordan Brushed Nickel Double Hook Wall Mount Towel Hook, Model #FSI 657-RH BNIC, Basis of Design or prior approved equivalent.
3. Single Post Toilet Paper Holder – allen + roth, Jordan Brushed Nickel Wall Mount single post toilet paper holder. Model #FSI 657-TP BNIC, Basis of Design or prior approved equivalent.

2.3 FABRICATION

A. Surface-Mounted Toilet Accessories, General: Except where otherwise indicated, fabricate units with tight seams and joints, exposed edges rolled. Provide concealed anchorage wherever possible.

B. Mirror Unit Hangers: Provide system for mounting mirror units that will permit rigid, tamperproof, and theft proof installation, as follows:

1. Heavy-duty wall brackets of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install toilet accessory units according to manufacturers' instructions, using fasteners appropriate to substrate as recommended by unit manufacturer. Install units plumb and level, firmly anchored in locations and at heights required.

B. Secure mirrors to walls in concealed, tamperproof manner with special hangers, toggle bolts, or screws. Set units plumb, level, and square at locations indicated, according to manufacturer's instructions for type of substrate involved.

C. Install grab bars to withstand a downward load of at least 250 lbf+, complying with ASTM F 446.

3.2 ADJUSTING AND CLEANING

A. Adjust toilet accessories for proper operation and verify that mechanisms function smoothly. Replace damaged or defective items.

B. Clean and polish all exposed surfaces strictly according to manufacturer's recommendations after removing temporary labels and protective coatings.

END OF SECTION 10 28 00

DIVISION 11: EQUIPMENT
Section 11450: Residential Appliances

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Residential appliances of the following types:

1. Undercounter Ice Maker
2. Refrigerator
3. Dishwasher
4. Oven /Range Combination
5. Over the Range Vented Microwave Hood Unit

1.2 RELATED SECTIONS

A. Section 06402 - Architectural Woodwork; cabinets and countertops.

1.3 REFERENCES

A. ANSI A117.1 - Guidelines for Accessible and Useable Buildings and Facilities.

B. EPA - Energy Star Appliances.

C. Public Law 101-336 - Americans with Disabilities Act.

1.4 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
1. Model number and selected options for each appliance.
2. Preparation instructions and recommendations.
3. Storage and handling requirements and recommendations.
4. Installation methods.
5. List of maintenance parts.

C. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with referenced standards and the Americans with Disabilities Act as applicable for fixtures for the disabled.

B. Coordinate rough-in requirements with adjacent construction. Coordinate components and fittings to ensure compatible parts are installed.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

1.7 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under

environmental conditions outside manufacturer's absolute limits.

1.8 WARRANTY

A. Provide manufacturer's standard written warranty for each type of appliance specified.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: GE, Basis of Design, Summit- Basis of Design, Kitchen Aide, Whirlpool, Maytag or prior approved equivalent.

1. Ice Maker – Summit, BIM44GADA, Under Counter ADA compliant.

2. Bottom Freezer Door Refrigerator – GE Energy Star 28.5 Cu.Ft. French Door Refrigerator, Model # GNE29GSHSS

3. Dishwasher – GE GDT630PYRFS – 24” Built in Dishwasher

4. Oven/Range Combination – GE 30” Smooth Surface 5 elements, 5.3 cf Self Cleaning Air Fry Convection Oven Free Standing Range (Stainless Steel) JB735SPSS

5. Over the Range Microwave – GE 1.9 Cu Ft Over the Range Microwave in Stainless Steel with Sensor Cooking, JNM7196SKSS

6. Requests for substitutions will be considered in accordance with provisions of Section 0160.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared. Coordinate rough-in with appliance sizes and utility requirements.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Assemble appliances and trim and install in accordance with manufacturer's instructions and the following:
1. Securely mount to substrate.
2. Install appliances plumb and level and in proper relationship to adjacent construction.
3. Connect appliances to building utility, supply and waste systems as applicable.
4. Test for proper operation and drainage. Adjust until proper operation is achieved.

3.4 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 11450

DIVISION 26: ELECTRICAL
Section 26 05 18 - Basic Electrical Materials and Methods

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
1. Supporting devices for electrical components.
2. Electrical identification.
3. Electricity-metering components.
4. Concrete equipment bases.
5. Electrical demolition.
6. Cutting and patching for electrical construction.
7. Touchup painting.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

1.4 COORDINATION

A. Coordinate chases, slots, inserts, sleeves, and openings with general construction work and arrange in building structure during progress of construction to facilitate the electrical installations that follow.

1. Set inserts and sleeves in poured-in-place concrete, masonry work, and other structural components as they are constructed.

B. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment requiring positioning before closing in the building.

C. Coordinate electrical service connections to components furnished by utility companies.

1. Coordinate installation and connection of exterior underground and overhead utilities and services, including provision for electricity-metering components.
2. Comply with requirements of authorities having jurisdiction and of utility company providing electrical power and other services.

D. Coordinate location of access panels and doors for electrical items that are concealed by finished surfaces. Access doors and panels are specified in Division 8 Section "Access Doors."

E. Where electrical identification devices are applied to field-finished surfaces, coordinate installation of identification devices with completion of finished surface.

F. Where electrical identification markings and devices will be concealed by acoustical ceilings and similar finishes, coordinate installation of these items before ceiling installation.

PART 2 - PRODUCTS

2.1 SUPPORTING DEVICES

A. Material: Cold-formed steel, with corrosion-resistant coating acceptable to authorities having jurisdiction.

B. Metal Items for Use Outdoors or in Damp Locations: Hot-dip galvanized steel.

C. Slotted-Steel Channel Supports: Flange edges turned toward web, and 9/16-inch- (14-mm-) diameter slotted holes at a maximum of 2 inches (50 mm) o.c., in webs.

1. Channel Thickness: Selected to suit structural loading.
2. Fittings and Accessories: Products of the same manufacturer as channel supports.

D. Raceway and Cable Supports: Manufactured clevis hangers, riser clamps, straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring-steel clamps or click-type hangers.

E. Pipe Sleeves: ASTM A 53, Type E, Grade A, Schedule 40, galvanized steel, plain ends.

F. Cable Supports for Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug for nonarmored electrical cables in riser conduits. Plugs have number and size of conductor gripping holes as required to suit individual risers. Body constructed of malleable-iron casting with hot-dip galvanized finish.

G. Expansion Anchors: Carbon-steel wedge or sleeve type.

H. Toggle Bolts: All-steel springhead type.

I. Powder-Driven Threaded Studs: Heat-treated steel.

2.2 ELECTRICAL IDENTIFICATION

A. Identification Devices: A single type of identification product for each application category. Use colors prescribed by ANSI A13.1, NFPA 70, and these Specifications.

B. Underground Warning Tape: Permanent, bright-colored, continuous-printed, vinyl tape with the following features:

1. Not less than 6 inches wide by 4 mils thick (150 mm wide by 0.102 mm thick).
2. Compounded for permanent direct-burial service.
3. Embedded continuous metallic strip or core.
4. Printed legend that indicates type of underground line.

C. Tape Markers for Wire: Vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.

D. Color-Coding Cable Ties: Type 6/6 nylon, self-locking type. Colors to suit coding scheme.

E. Engraved-Plastic Labels, Signs, and Instruction Plates: Engraving stock, melamine plastic laminate punched or drilled for mechanical fasteners 1/16-inch (1.6-mm) minimum thickness for signs up to 20 sq. in. (129 sq. cm) and 1/8-inch (3.2-mm) minimum thickness for larger sizes. Engraved legend in black letters on white background.

F. Interior Warning and Caution Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145. Preprinted, aluminum, baked-enamel-finish signs, punched or drilled for mechanical fasteners, with colors, legend, and size appropriate to the application.

G. Exterior Warning and Caution Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch (1-mm), galvanized-steel backing, with colors, legend, and size appropriate to the application. 1/4-inch (6-mm) grommets in corners for mounting.

H. Fasteners for Nameplates and Signs: Self-tapping, stainless-steel screws or No. 10/32 stainless-steel machine screws with nuts and flat and lock washers.

2.3 EQUIPMENT FOR UTILITY COMPANY'S ELECTRICITY METERING

A. Meter Sockets: Comply with requirements of electrical power utility company.

2.4 CONCRETE BASES

A. Concrete Forms and Reinforcement Materials: As specified in Division 3 Section "Cast-in-Place Concrete."

B. Concrete: 3000-psi (20.7-MPa), 28-day compressive strength as specified in Division 3 Section "Cast-in-Place Concrete."

2.5 TOUCHUP PAINT

A. For Equipment: Equipment manufacturer's paint selected to match installed equipment finish.

B. Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

PART 3 - EXECUTION

3.1 ELECTRICAL EQUIPMENT INSTALLATION

A. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide the maximum possible headroom.

B. Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.

C. Equipment: Install to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.

D. Right of Way: Give to raceways and piping systems installed at a required slope.

3.2 WIRING INSTALLATION

A. Install splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

B. Install wiring at outlets with at least 12 inches (300 mm) of slack conductor at each outlet.

C. Connect outlet and component connections to wiring systems and to ground. Tighten electrical connectors and terminals, according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.

3.3 ELECTRICAL SUPPORTING DEVICE APPLICATION

A. Damp Locations and Outdoors: Hot-dip galvanized materials or nonmetallic, U-channel system components.

B. Dry Locations: Steel materials.

C. Support Clamps for PVC Raceways: Click-type clamp system.

D. Selection of Supports: Comply with manufacturer's written instructions.

E. Strength of Supports: Adequate to carry present and future loads, times a safety factor of at least four; minimum of 200-lb (90-kg) design load.

3.4 SUPPORT INSTALLATION

A. Install support devices to securely and permanently fasten and support electrical components.

B. Install individual and multiple raceway hangers and riser clamps to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assemblies and for securing hanger rods and conduits.

C. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.

D. Size supports for multiple raceway installations so capacity can be increased by a 25 percent minimum in the future.

E. Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps.

F. Install 1/4-inch- (6-mm-) diameter or larger threaded steel hanger rods, unless otherwise indicated.

G. Spring-steel fasteners specifically designed for supporting single conduits or tubing may be used instead of malleable-iron hangers for 3/4-inch and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings and for fastening raceways to slotted channel and angle supports.

H. Arrange supports in vertical runs so the weight of raceways and enclosed conductors is carried entirely by raceway supports, with no weight load on raceway terminals.

I. Simultaneously install vertical conductor supports with conductors.

J. Separately support cast boxes that are threaded to raceways and used for fixture support. Support sheet-metal boxes directly from the building structure or by bar hangers. If bar hangers are used, attach bar to raceways on opposite sides of the box and support the raceway with an approved fastener not more than 24 inches (610 mm) from the box.

K. Install metal channel racks for mounting cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices unless components are mounted directly to structural elements of adequate strength.

L. Install sleeves for cable and raceway penetrations of concrete slabs and walls unless core-drilled holes are used. Install sleeves for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls.

M. Securely fasten electrical items and their supports to the building structure, unless otherwise indicated. Perform fastening according to the following unless other fastening methods are indicated:

1. Wood: Fasten with wood screws or screw-type nails.
2. Masonry: Toggle bolts on hollow masonry units and expansion bolts on solid masonry units.
3. New Concrete: Concrete inserts with machine screws and bolts.
4. Existing Concrete: Expansion bolts.
5. Instead of expansion bolts, threaded studs driven by a powder charge and provided with lock washers may be used in existing concrete.
6. Steel: Welded threaded studs or spring-tension clamps on steel.

    a. Field Welding: Comply with AWS D1.1.

7. Welding to steel structure may be used only for threaded studs, not for conduits, pipe straps, or other items.
8. Light Steel: Sheet-metal screws.
9. Fasteners: Select so the load applied to each fastener does not exceed 25 percent of its proof-test load.

3.5 IDENTIFICATION MATERIALS AND DEVICES

A. Install at locations for most convenient viewing without interference with operation and maintenance of equipment.

B. Coordinate names, abbreviations, colors, and other designations used for electrical identification with corresponding designations indicated in the Contract Documents or required by codes and standards. Use consistent designations throughout Project.

C. Self-Adhesive Identification Products: Clean surfaces before applying.

D. Tag and label circuits designated to be extended in the future. Identify source and circuit numbers in each cabinet, pull and junction box, and outlet box. Color-coding may be used for voltage and phase identification.

E. Install continuous underground plastic markers during trench backfilling, for exterior underground power, control, signal, and communication lines located directly above power and communication lines. Locate 6 to 8 inches (150 to 200 mm) below finished grade. If width of multiple lines installed in a common trench or concrete envelope does not exceed 16 inches (400 mm), overall, use a single line marker.

F. Install warning, caution, and instruction signs where required to comply with 29 CFR, Chapter XVII, Part 1910.145, and where needed to ensure safe operation and maintenance of electrical systems and of items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.

3.6 UTILITY COMPANY ELECTRICITY-METERING EQUIPMENT

A. Install equipment according to utility company's written requirements. Provide grounding and empty conduits as required by utility company.

3.7 FIRESTOPPING

A. Apply firestopping to cable and raceway penetrations of fire-rated floor and wall assemblies to achieve fire-resistance rating of the assembly. The firestopping shall be made in accordance with a UL listed assembly.

3.8 CONCRETE BASES

A. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger, in both directions, than supported unit. Follow supported equipment manufacturer's anchorage recommendations and setting templates for anchor-bolt and tie locations, unless otherwise indicated. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Division 3 Section "Cast-in-Place Concrete."

3.9 DEMOLITION

A. Protect existing electrical equipment and installations indicated to remain. If damaged or disturbed in the course of the Work, remove damaged portions and install new products of equal capacity, quality, and functionality.

B. Accessible Work: Remove exposed electrical equipment and installations, indicated to be demolished, in their entirety.

C. Abandoned Work: Cut and remove buried raceway and wiring, indicated to be abandoned in place, 2 inches (50 mm) below the surface of adjacent construction. Cap raceways and patch surface to match existing finish.

D. Remove demolished material from Project site.

E. Remove, store, clean, reinstall, reconnect, and make operational components indicated for relocation.

3.10 CUTTING AND PATCHING

A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. Perform cutting by skilled mechanics of trades involved.

B. Repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces. Install new fireproofing where existing firestopping has been disturbed. Repair and refinish materials and other surfaces by skilled mechanics of trades involved.

3.11 FIELD QUALITY CONTROL

A. Inspect installed components for damage and faulty work, including the following:

1. Supporting devices for electrical components.
2. Electrical identification.
3. Electricity-metering components.
4. Concrete bases.
5. Electrical demolition.
6. Cutting and patching for electrical construction.
7. Touchup painting.

3.12 REFINISHING AND TOUCHUP PAINTING

A. Refinish and touch up paint.

1. Clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit the degree of damage at each location.
2. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.
3. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
4. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.13 CLEANING AND PROTECTION

A. On completion of installation, including outlets, fittings, and devices, inspect exposed finish. Remove burrs, dirt, paint spots, and construction debris.

B. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

END OF SECTION 26 0518

DIVISION 26: ELECTRICAL
Section 26 05 19 - Conductors and Cables

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.

1.3 SUBMITTALS

A. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

1.4 QUALITY ASSURANCE

A. Listing and Labeling: Provide wires and cables specified in this Section that are listed and labeled.

1. The Terms "Listed" and "Labeled": As defined in NFPA 70, Article 100.
2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.

B. Comply with NFPA 70.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver wires and cables according to NEMA WC 26.

1.6 COORDINATION

A. Coordinate layout and installation of cables with other installations.

B. Revise locations and elevations from those indicated, as required to suit field conditions and as approved by Architect.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Wires and Cables:

a. American Insulated Wire Corp.; Leviton Manufacturing Co.
b. BICC Brand-Rex Company.
c. Senator Wire & Cable Company.
d. Southwire Company.

2. Connectors for Wires and Cables:

a. AMP Incorporated.
b. General Signal; O-Z/Gedney Unit.
c. Monogram Co.; AFC.
d. Square D Co.; Anderson.
e. 3M Company; Electrical Products Division.

2.2 BUILDING WIRES AND CABLES

A. UL-listed building wires and cables with conductor material, insulation type, cable construction, and rating as specified in Part 3 "Wire and Insulation Applications" Article.

B. Rubber Insulation Material: Comply with NEMA WC 3.

C. Thermoplastic Insulation Material: Comply with NEMA WC 5.

D. Cross-Linked Polyethylene Insulation Material: Comply with NEMA WC 7.

E. Ethylene Propylene Rubber Insulation Material: Comply with NEMA WC 8.

F. Conductor Material: Copper.

G. Stranding: Solid conductor for No. 10 AWG and smaller; stranded conductor for larger than No. 10 AWG.

2.3 CONNECTORS AND SPLICES

A. UL-listed, factory-fabricated wiring connectors of size, ampacity rating, material, type, and class for application and service indicated. Comply with Project's installation requirements and as specified in Part 3 "Wire and Insulation Applications" Article.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine raceways and building finishes to receive wires and cables for compliance with requirements for installation tolerances and other conditions affecting performance of wires and cables. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 WIRE AND INSULATION APPLICATIONS

A. Service Entrance: Type RHW or THWN, in raceway.

B. Feeders: Type THHN/THWN, in raceway.

C. Branch Circuits: Type THHN/THWN, in raceway.

D. Fire Alarm Circuits: Type THHN/THWN, in raceway.

E. Class 1 Control Circuits: Type THHN/THWN, in raceway.

F. Class 2 Control Circuits: Type THHN/THWN, in raceway.

3.3 INSTALLATION

A. Install wires and cables as indicated, according to manufacturer's written instructions and NECA's "Standard of Installation."

B. Remove existing wires from raceway before pulling in new wires and cables.

C. Pull Conductors: Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

E. Install exposed cables, parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

F. Support cables according to Division 26 Section "Basic Electrical Materials and Methods."

G. Seal around cables penetrating fire-rated elements according to Division 7 Section "Firestopping."

H. Identify wires and cables according to Division 26 Section "Basic Electrical Materials and Methods."

3.4 CONNECTIONS

A. Conductor Splices: Keep to minimum.

B. Install splices and tapes that possess equivalent or better mechanical strength and insulation ratings than conductors being spliced.

C. Use splice and tap connectors compatible with conductor material.

D. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches (300 mm) of slack.

E. Connect outlets and components to wiring and to ground as indicated and instructed by manufacturer.

F. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.5 FIELD QUALITY CONTROL

A. Testing: On installation of wires and cables and before electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

1. Procedures: Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.3.1. Certify compliance with test parameters.

B. Correct malfunctioning conductors and cables at Project site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units and retest.

END OF SECTION 26 0519

DIVISION 26: ELECTRICAL
Section 26 05 26 - Grounding and Bonding

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1. Comply with UL 467.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Grounding Conductors, Cables, Connectors, and Rods:

a. Apache Grounding/Erico Inc.
b. Chance/Hubbell.
c. Copperweld Corp.
d. Dossert Corp.
e. Erico Inc.; Electrical Products Group.
f. Framatome Connectors/Burndy Electrical.
g. Galvan Industries, Inc.
h. Ideal Industries, Inc.
i. ILSCO.
j. Kearney/Cooper Power Systems.
k. Lyncole XIT Grounding.
l. O-Z/Gedney Co.; a business of the EGS Electrical Group.
m. Raco, Inc.; Division of Hubbell.
n. Thomas & Betts, Electrical.

2.2 GROUNDING CONDUCTORS

A. For insulated conductors, comply with Division 26 Section "Conductors and Cables."

B. Equipment Grounding Conductors: Insulated with green-colored insulation.

C. Isolated Ground Conductors: Insulated with green-colored insulation with yellow stripe. On feeders with isolated ground, use colored tape, alternating bands of green and yellow tape to provide a minimum of three bands of green and two bands of yellow.

D. Grounding Electrode Conductors: Stranded cable.

E. Underground Conductors: Bare, tinned, stranded, unless otherwise indicated.

F. Bare Copper Conductors: Comply with the following:

1. Solid Conductors: ASTM B 3.
2. Assembly of Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.

G. Copper Bonding Conductors: As follows:

1. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG copper conductor, 1/4 inch (6.4 mm) in diameter.
2. Bonding Conductor: No. 4 or No. 6 AWG, stranded copper conductor.
3. Bonding Jumper: Bare copper tape, braided bare copper conductors, terminated with copper ferrules; 1-5/8 inches (42 mm) wide and 1/16 inch (1.5 mm) thick.
4. Tinned Bonding Jumper: Tinned-copper tape, braided copper conductors, terminated with copper ferrules; 1-5/8 inches (42 mm) wide and 1/16 inch (1.5 mm) thick.

H. Grounding Bus: Bare, annealed copper bars of rectangular cross section, with insulators.

2.3 CONNECTOR PRODUCTS

A. Comply with IEEE 837 and UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items.

B. Bolted Connectors: Bolted-pressure-type connectors, or compression type.

C. Welded Connectors: Exothermic-welded type, in kit form, and selected per manufacturer's written instructions.

2.4 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel.

1. Size: 3/4 by 120 inches.

PART 3 - EXECUTION

3.1 APPLICATION

A. In raceways, use insulated equipment grounding conductors.

B. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections.

C. Equipment Grounding Conductor Terminations: Use bolted pressure clamps.

3.2 EQUIPMENT GROUNDING CONDUCTORS

A. Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.

B. Install equipment grounding conductors in all feeders and circuits.

C. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate grounding conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.

D. Nonmetallic Raceways: Install an equipment grounding conductor in nonmetallic raceways unless they are designated for telephone or data cables.

E. Air-Duct Equipment Circuits: Install an equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners and heaters. Bond conductor to each unit and to air duct.

F. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate equipment grounding conductor to each electric water heater, heat-tracing, and antifrost heating cable. Bond conductor to heater units, piping, connected equipment, and components.

G. Signal and Communication Systems: For telephone, alarm, voice and data, and other communication systems, provide insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.

1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a grounding bus.
2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

H. Metal Poles Supporting Outdoor Lighting Fixtures: Provide a grounding electrode in addition to installing a separate equipment grounding conductor with supply branch-circuit conductors.

3.3 INSTALLATION

A. Ground Rods: Install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes.

1. Drive ground rods until tops are 2 inches (50 mm) below finished floor or final grade, unless otherwise indicated.
2. Interconnect ground rods with grounding electrode conductors. Use exothermic welds, except at test wells and as otherwise indicated. Make connections without exposing steel or damaging copper coating.

B. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

C. Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers and supports is not transmitted to rigidly mounted equipment. Use exothermic-welded connectors for outdoor locations, unless a disconnect-type connection is required; then, use a bolted clamp. Bond straps directly to the basic structure taking care not to penetrate any adjacent parts. Install straps only in locations accessible for maintenance.

D. Metal Water Service Pipe: Provide insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes by grounding clamp connectors. Where a dielectric main water fitting is installed, connect grounding conductor to street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.

E. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with grounding clamp connectors.

F. Bond interior metal piping systems and metal air ducts to equipment grounding conductors of associated pumps, fans, blowers, electric heaters, and air cleaners. Use braided-type bonding straps.

G. Bond each aboveground portion of gas piping system upstream from equipment shutoff valve.

3.4 CONNECTIONS

A. General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
2. Make connections with clean, bare metal at points of contact.
3. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

B. Exothermic-Welded Connections: Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.

C. Equipment Grounding Conductor Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.

D. Noncontact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically noncontinuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.

E. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.

F. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.

G. Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

3.5 FIELD QUALITY CONTROL

A. Testing: Perform the following field quality-control testing:

1. After installing grounding system but before permanent electrical circuitry has been energized, test for compliance with requirements.

    a. Equipment Rated 500 kVA and Less: 10 ohms.
    b. Equipment Rated 500 to 1000 kVA: 5 ohms.
    c. Equipment Rated More Than 1000 kVA: 3 ohms.

2. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 26 0526

DIVISION 26: ELECTRICAL
Section 26 05 33 – Raceways and Boxes

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1. Raceways include the following:

a. RMC.
b. IMC.
c. EMT.
d. FMC.
e. LFMC.
f. LFNC.
g. RNC.

2. Boxes, enclosures, and cabinets include the following:

a. Device boxes.
b. Outlet boxes.
c. Pull and junction boxes.

B. Related Sections include the following:

1. Division 7 Section "Firestopping."
2. Division 26 Section "Basic Electrical Materials and Methods" for raceways and box supports.
3. Division 26 Section "Wiring Devices" for devices installed in boxes and for floor-box service fittings.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. ENT: Electrical nonmetallic tubing.

C. FMC: Flexible metal conduit.

D. IMC: Intermediate metal conduit.

E. LFMC: Liquidtight flexible metal conduit.

F. LFNC: Liquidtight flexible nonmetallic conduit.

G. RMC: Rigid metal conduit.

H. RNC: Rigid nonmetallic conduit.

1.4 QUALITY ASSURANCE

A. Listing and Labeling: Provide raceways and boxes specified in this Section that are listed and labeled.

1. The Terms "Listed" and "Labeled": As defined in NFPA 70, Article 100.
2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.

B. Comply with NECA's "Standard of Installation."

C. Comply with NFPA 70.

1.5 COORDINATION

A. Coordinate layout and installation of raceways and boxes with other construction elements to ensure adequate headroom, working clearance, and access.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Metal Conduit and Tubing:

a. Alflex Corp.
b. Anamet, Inc.; Anaconda Metal Hose.
c. Anixter Brothers, Inc.
d. Grinnell Co.; Allied Tube and Conduit Div.
e. Monogram Co.; AFC.
f. Wheatland Tube Co.

2. Nonmetallic Conduit and Tubing:

a. Anamet, Inc.; Anaconda Metal Hose.
b. Hubbell, Inc.; Raco, Inc.
c. Lamson & Sessions; Carlon Electrical Products.
d. R&G Sloan Manufacturing Co., Inc.
e. Thomas & Betts Corp.

3. Conduit Bodies and Fittings:

a. American Electric; Construction Materials Group.
b. Crouse-Hinds; Div. of Cooper Industries.
c. Emerson Electric Co.; Appleton Electric Co.
d. Hubbell, Inc.; Killark Electric Manufacturing Co.

e. Lamson & Sessions; Carlon Electrical Products.
f. O-Z/Gedney; Unit of General Signal.
g. Scott Fetzer Co.; Adalet-PLM.
h. Spring City Electrical Manufacturing Co.

4. Boxes, Enclosures, and Cabinets:

a. Crouse-Hinds; Div. of Cooper Industries.
b. Electric Panelboard Co., Inc.
c. Erickson Electrical Equipment Co.
d. Hoffman Engineering Co.; Federal-Hoffman, Inc.
e. Hubbell Inc.; Killark Electric Manufacturing Co.
f. Hubbell Inc.; Raco, Inc.
g. Lamson & Sessions; Carlon Electrical Products.
h. O-Z/Gedney; Unit of General Signal.
i. Thomas & Betts Corp.
j. Woodhead Industries, Inc.; Daniel Woodhead Co.

2.2 METAL CONDUIT AND TUBING

A. Rigid Steel Conduit: ANSI C80.1.

B. IMC: ANSI C80.6.

C. Plastic-Coated Steel Conduit and Fittings: NEMA RN 1.

D. Plastic-Coated IMC and Fittings: NEMA RN 1.

E. EMT and Fittings: ANSI C80.3.

1. Fittings: Compression type.

F. FMC: Zinc-coated steel.

G. LFMC: Flexible steel conduit with PVC jacket.

H. Fittings: NEMA FB 1; compatible with conduit/tubing materials.

2.3 NONMETALLIC CONDUIT AND TUBING

A. RNC: NEMA TC 2, Schedule 40 or 80 PVC.

B. RNC Fittings: NEMA TC 3; match to conduit or conduit/tubing type and material.

C. LFNC: UL 1660.

2.4 OUTLET AND DEVICE BOXES

A. Sheet Metal Boxes: NEMA OS 1.

B. Cast-Metal Boxes: NEMA FB 1, Type FD, cast box with gasketed cover.

C. Nonmetallic Boxes: NEMA OS 2.

2.5 PULL AND JUNCTION BOXES

A. Small Sheet Metal Boxes: NEMA OS 1.

B. Cast-Metal Boxes: NEMA FB 1, cast aluminum with gasketed cover.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces to receive raceways, boxes, enclosures, and cabinets for compliance with installation tolerances and other conditions affecting performance of raceway installation. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 WIRING METHODS

A. Outdoors: Use the following wiring methods:

1. Exposed: Rigid steel or IMC.
2. Concealed: Rigid steel or IMC.
3. Underground, Single Run: RNC.
4. Underground, Grouped: RNC.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
6. Boxes and Enclosures: NEMA 250, Type 3R or Type 4.

B. Indoors: Use the following wiring methods:

1. Exposed: Rigid steel or IMC.
2. Concealed: MC cable.
3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC; except in wet or damp locations, use LFMC.
4. Damp or Wet Locations: Rigid steel conduit.
5. Boxes and Enclosures: NEMA 250, Type 1, except as follows:

    a. Damp or Wet Locations: NEMA 250, Type 3R.

3.3 INSTALLATION

A. Install raceways, boxes, enclosures, and cabinets as indicated, according to manufacturer's written instructions.

B. Minimum Raceway Size: 1/2-inch trade size (DN16).

C. Conceal MC cable and EMT, unless otherwise indicated, within finished walls, ceilings, and floors.

D. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

E. Install raceways level and square and at proper elevations. Provide adequate headroom.

F. Complete raceway installation before starting conductor installation.

G. Support raceways as specified in Division 26 Section "Basic Electrical Materials and Methods."

H. Use temporary closures to prevent foreign matter from entering raceways.

I. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portion of bends is not visible above the finished slab.

J. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and straight legs of offsets parallel, unless otherwise indicated.

K. Use raceway fittings compatible with raceways and suitable for use and location. For intermediate steel conduit, use threaded rigid steel conduit fittings, unless otherwise indicated.

L. Run concealed raceways, with a minimum of bends, in the shortest practical distance considering the type of building construction and obstructions, unless otherwise indicated.

M. Raceways Embedded in Slabs: Install in middle third of slab thickness where practical, and leave at least 1-inch (25-mm) concrete cover.

1. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.
2. Space raceways laterally to prevent voids in concrete.
3. Run conduit larger than 1-inch trade size (DN27) parallel to or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
4. Transition from nonmetallic tubing to rigid steel conduit before rising above floor.

N. Install exposed raceways parallel to or at right angles to nearby surfaces or structural members, and follow the surface contours as much as practical.

1. Run parallel or banked raceways together, on common supports where practical.
2. Make bends in parallel or banked runs from same centerline to make bends parallel. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.

O. Join raceways with fittings designed and approved for the purpose and make joints tight.

1. Make raceway terminations tight. Use bonding bushings or wedges at connections subject to vibration. Use bonding jumpers where joints cannot be made tight.
2. Use insulating bushings to protect conductors.

P. Terminations: Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against the box. Where terminations are not secure with 1 locknut, use 2 locknuts: 1 inside and 1 outside the box.

Q. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align raceways so the coupling is square to the box and tighten the chase nipple so no threads are exposed.

R. Install pull wires in empty raceways. Use No. 14 AWG zinc-coated steel or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of the pull wire.

S. Flexible Connections: Use maximum of 6 feet (1830 mm) of flexible conduit for recessed and semirecessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use liquidtight flexible conduit in wet or damp locations. Install separate ground conductor across flexible connections.

T. Do not install aluminum conduits embedded in or in contact with concrete.

U. Install hinged-cover enclosures and cabinets plumb. Support at each corner.

3.4 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure coatings, finishes, and cabinets are without damage or deterioration at the time of Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.5 CLEANING

A. On completion of installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions.

END OF SECTION 26 0533

DIVISION 26: ELECTRICAL
Section 26 24 16 - Panelboards

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes panelboards, overcurrent protective devices, and associated auxiliary equipment rated 600 V and less for the following types:

1. Lighting and appliance branch-circuit panelboards.

2. Distribution panelboards.

1.3 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. RFI: Radio-frequency interference.

D. RMS: Root mean square.

E. SPDT: Single pole, double throw.

F. TVSS: Transient voltage surge suppressor.

1.4 SUBMITTALS

A. Product Data: For each type of panelboard, overcurrent protective device, TVSS device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:
   a. Enclosure types and details for types other than NEMA 250, Type 1.
   b. Bus configuration, current, and voltage ratings.
   c. Short-circuit current rating of panelboards and overcurrent protective devices.
   d. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NEMA PB 1.

C. Comply with NFPA 70.

1.6 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, and encumbrances to workspace clearance requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Panelboards, Overcurrent Protective Devices, Controllers, Contactors, and Accessories:
   a. General Electric Co.; Electrical Distribution & Control Div.
   b. Eaton
   c. Square D Co.

2.2 FABRICATION AND FEATURES

A. Enclosures: Flush or surface mounted cabinets as indicated on drawings. NEMA PB 1, Type 1, to meet environmental conditions at installed location.

1. Outdoor Locations: NEMA 250, Type 3R.

B. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.

C. Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.

D. Directory Card: With transparent protective cover, mounted inside metal frame, inside panelboard door.

E. Bus: Hard-drawn copper, 98 percent conductivity.

F. Main and Neutral Lugs: Mechanical type suitable for use with conductor material.

G. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors; bonded to box.

H. Service Equipment Label: UL labeled for use as service equipment for panelboards with main service disconnect switches.

I. Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices.

J. Isolated Equipment Ground Bus: When noted on drawings, install isolated equipment ground bus adequate for branch-circuit equipment ground conductors; insulated from box.

K. Feed-through Lugs: Mechanical type suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device. Provide only when necessary or when noted on the drawings.

2.3 PANELBOARD SHORT-CIRCUIT RATING

A. Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.4 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

B. Doors: Front mounted with concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.5 DISTRIBUTION PANELBOARDS

A. Doors: Front mounted, except omit in fused-switch panelboards; secured with vault-type latch with tumbler lock; keyed alike.

B. Main Overcurrent Protective Devices: Circuit breaker.

C. Branch overcurrent protective devices shall be one of the following:

1. For Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.

2. For Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

3. Fused switches.

2.6 OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.

3. Electronic Trip Unit Circuit Breakers: RMS sensing; field-replaceable rating plug; with the following field-adjustable settings:
   a. Instantaneous trip.
   b. Long- and short-time pickup levels.
   c. Long- and short-time time adjustments.
   d. Ground-fault pickup level, time delay, and I^2t response.

4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.

5. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker; trip activation on fuse opening or on opening of fuse compartment door.

6. GFCI Circuit Breakers: Single- and two-pole configurations with 5-mA trip sensitivity.

B. Molded-Case Circuit-Breaker Features and Accessories. Standard frame sizes, trip ratings, and number of poles.

1. Lugs: Mechanical style, suitable for number, size, trip ratings, and material of conductors.

2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.

3. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.

4. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install panelboards and accessories according to NEMA PB 1.1.

B. Mounting Heights: Top of trim 74 inches (1880 mm) above finished floor, unless otherwise indicated.

C. Mounting: Plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.

D. Circuit Directory: Create a directory to indicate installed circuit loads. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

E. Install filler plates in unused spaces.

F. Wiring in Panelboard Gutters: Arrange conductors into groups and bundle and wrap with wire ties.

3.2 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 16 Section "Basic Electrical Materials and Methods".

B. Panelboard Nameplates: Label each panelboard with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.

3.3 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 FIELD QUALITY CONTROL

A. Testing: After installing panelboards and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

1. Procedures: Perform each visual and mechanical inspection and electrical test indicated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.

2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.5 ADJUSTING

A. Set field-adjustable switches and circuit-breaker trip ranges.

3.6 CLEANING

A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION 26 24 16

SECTION 26 27 26 – WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes receptacles, connectors, switches, and finish plates.

1.3 DEFINITIONS

A. GFCI: Ground-fault circuit interrupter.

B. TVSS: Transient voltage surge suppressor.

1.4 SUBMITTALS

A. Product Data: For each product specified.

B. Maintenance Data: For materials and products to include in maintenance manuals specified in Division 1.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

B. Comply with NEMA WD 1.

C. Comply with NFPA 70.

1.6 COORDINATION

A. Receptacles for Owner-Furnished Equipment: Match plug configurations.

1. Cord and Plug Sets: Match equipment requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Wiring Devices:

a. Bryant Electric, Inc.
b. Eagle Electric Manufacturing Co., Inc.
c. Hubbell, Inc.; Wiring Devices Div.
d. Leviton Manufacturing Co., Inc.
e. Pass & Seymour/Legrand; Wiring Devices Div.

2. Wiring Devices for Hazardous (Classified) Locations:

a. Crouse-Hinds Electrical Co.; Distribution Equipment Div.
b. Killark Electric Manufacturing Co.

3. Multioutlet Assemblies:

a. Wiremold.

4. Poke-through, Floor Service Outlets and Telephone/Power Poles:

a. Hubbell, Inc.; Wiring Devices Div.
b. Wiremold.

2.2 RECEPTACLES

A. Straight-Blade and Locking Receptacles: Heavy-Duty grade, 20A.

B. GFCI Receptacles: Termination type, with integral NEMA WD 6, Configuration 5-20R duplex receptacle. Design units for installation in a 2-3/4-inch- (70-mm-) deep outlet box without an adapter.

C. Hazardous (Classified) Location Receptacles: Comply with NEMA FB 11.

2.3 CORD AND PLUG SETS

A. Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.

1. Cord: Rubber-insulated, stranded-copper conductors, with type SOW-A jacket. Green-insulated grounding conductor, and equipment-rating ampacity plus a minimum of 30 percent.
2. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.4 SWITCHES

A. Snap Switches: Heavy-duty, quiet type.

B. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on/off switches and audible and electromagnetic noise filters.

1. Control: Continuously adjustable slide. Single-pole or three-way switch to suit connections.
2. Incandescent Lamp Dimmers: Modular, 120 V, 60 Hz with continuously adjustable slide; single pole with soft tap or other quiet switch; electromagnetic filter to eliminate noise, RF, and TV interference; and 5-inch (130-mm) wire connecting leads.
3. Fluorescent Lamp Dimmers: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming to a maximum of 1 percent of full brightness.

2.5 WALL PLATES

A. Single and combination types match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: 0.04-inch- (1-mm-) thick, Type 302, satin-finished stainless steel.
3. Material for Unfinished Spaces: Galvanized steel.

2.6 FLOOR SERVICE FITTINGS

A. Type: Modular, flush-type, dual-service units suitable for wiring method used.

B. Compartmentation: Barrier separates power and signal compartments.

C. Housing Material: Die-cast aluminum, satin finished.

D. Power Receptacle: NEMA WD 6, Configuration 5-20R, gray finish, unless otherwise indicated.

E. Signal Outlet: Blank cover with bushed cable opening, unless otherwise indicated.

2.7 POKE-THROUGH ASSEMBLIES

A. Description: Factory-fabricated and -wired assembly of below-floor junction box unit with multichanneled, through-floor raceway/firestop unit and detachable matching floor service-outlet assembly.

1. Size: Selected to fit nominal 3-inch (75-mm) cored holes in floor and matched to floor thickness.
2. Fire Rating: Unit is listed and labeled for fire rating of floor-ceiling assembly.
3. Closure Plug: Arranged to close unused 3-inch (75-mm) cored openings and reestablish fire rating of floor.

2.8 MULTIOUTLET ASSEMBLIES

A. Components of Assemblies: Products from a single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.

B. Raceway Material: Metal, with manufacturer's standard finish.

2.9 FINISHES

A. Color: Gray, unless otherwise indicated or required by Code.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install devices and assemblies plumb and secure.

B. Install wall plates when painting is complete.

C. Install wall dimmers to achieve indicated rating after derating for ganging as instructed by manufacturer.

D. Do not share neutral conductor on load side of dimmers.

E. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical, and grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

F. Protect devices and assemblies during painting.

G. Adjust locations at which floor service outlets and telephone/power service poles are installed to suit arrangement of partitions and furnishings.

3.2 IDENTIFICATION

A. Comply with Division 26 Section "Basic Electrical Materials and Methods."

1. Switches: Where three or more switches are ganged, and elsewhere as indicated, identify each switch with approved legend engraved on wall plate.

3.3 CONNECTIONS

A. Connect wiring device grounding terminal to outlet box with bonding jumper.

B. Isolated-Ground Receptacles: Connect to isolated-ground conductor routed to designated isolated equipment ground terminal of electrical system.

C. Tighten electrical connectors and terminals according to manufacturers published torque-tightening values. If manufacturers torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 FIELD QUALITY CONTROL

A. Test wiring devices for proper polarity and ground continuity. Operate each device at least six times.

B. Test GFCI operation with both local and remote fault simulations according to manufacturer's written instructions.

C. Replace damaged or defective components.

3.5 CLEANING

A. Internally clean devices, device outlet boxes, and enclosures. Replace stained or improperly painted wall plates or devices.

END OF SECTION 26 2726

DIVISION 26: ELECTRICAL
Section 26 28 13 - Fuses

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Fuses.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain fuses from one source and by a single manufacturer.

B. Comply with NFPA 70 for components and installation.

C. Listing and Labeling: Provide fuses specified in this Section that are listed and labeled.

1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.

2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide fuses by one of the following:

1. Cooper Industries, Inc.; Bussmann Div.

2. General Electric Co.; Wiring Devices Div.

3. Gould Shawmut.

4. Tracor, Inc.; Littelfuse, Inc. Subsidiary.

2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, nonrenewable cartridge fuse; class as specified or indicated; current rating as indicated; voltage rating consistent with circuit voltage.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine utilization equipment nameplates and installation instructions to verify proper fuse locations, sizes, and characteristics.

B. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

A. Main Service: Class L, fast acting.

B. Main Feeders: Class J, time delay.

C. Motor Branch Circuits: Class RK1, time delay.

D. Other Branch Circuits: Class RK5, non-time delay.

3.3 INSTALLATION

A. Install fuses in fusible devices as indicated. Arrange fuses so fuse ratings are readable without removing fuse.

3.4 IDENTIFICATION

A. Install typewritten labels on inside door of each fused switch to indicate fuse replacement information.

END OF SECTION 26 2813

DIVISION 26: ELECTRICAL
Section 26 28 16 - Disconnect Switches

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes individually mounted switches used for the following:
   1. Feeder and equipment disconnect switches.
   2. Motor disconnect switches.

B. Related Sections: The following Sections contain requirements that relate to this Section:
   1. Division 26 Section "Fuses" for fuses in fusible disconnect switches.

1.3 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product Data for disconnect switches and accessories specified in this Section.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain disconnect switches from one source and by a single manufacturer.

B. Comply with NFPA 70 for components and installation.

C. Listing and Labeling: Provide disconnect switches specified in this Section that are listed and labeled.
   1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.
   2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide disconnect switches by one of the following:
   1. Switches:
      a. General Electric Co.; Electrical Distribution and Control Division.

b. Eaton
c. Square D Co.

2.2 DISCONNECT SWITCHES

A. Enclosed, Nonfusible Switch: NEMA KS 1, Type HD, with lockable handle.

B. Enclosed, Fusible Switch, 800 A and Smaller: NEMA KS 1, Type HD, clips to accommodate specified fuses, enclosure consistent with environment where located, handle lockable with 2 padlocks, and interlocked with cover in CLOSED position.

C. Enclosure: NEMA KS 1, Type 1, unless otherwise specified or required to meet environmental conditions of installed location.
1. Outdoor Locations: Type 3R.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install disconnect switches in locations as indicated, according to manufacturer's written instructions.

B. Install disconnect switches level and plumb.

C. Connect disconnect switches and components to wiring system and to ground as indicated and instructed by manufacturer.
1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

D. Identify each disconnect switch according to requirements specified in Division 16 Section "Basic Electrical Materials and Methods."

3.2 FIELD QUALITY CONTROL

A. Testing: After installing disconnect switches and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.
1. Procedures: Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.5 for disconnect switches. Certify compliance with test parameters.

B. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units and retest.

3.3 CLEANING

A. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish including chips, scratches, and abrasions.

END OF SECTION 26 2816

DIVISION 26: ELECTRICAL
Section 26 51 00 – Interior Lighting

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes interior lighting fixtures, lighting fixtures mounted on exterior building surfaces, lamps, ballasts, emergency lighting units, and accessories.

1.3 SUBMITTALS

A. Product Data: For each type of lighting fixture indicated, arranged in order of fixture designation. Include data on features, accessories, and the following:

1. Dimensions of fixtures.

2. Certified results of laboratory tests for fixtures and lamps for photometric performance.

3. Emergency lighting unit battery and charger.

4. Fluorescent and high-intensity-discharge ballasts.

5. Types of lamps.

1.4 QUALITY ASSURANCE

A. Fixtures, Emergency Lighting Units, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

B. Comply with NFPA 70.

C. NFPA 101 Compliance: Comply with visibility and luminance requirements for exit signs.

1.5 COORDINATION

A. Fixtures, Mounting Hardware, and Trim: Coordinate layout and installation of lighting fixtures with ceiling system and other construction.

1.6 WARRANTY

A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Special Warranty for Batteries: Written warranty, executed by manufacturer agreeing to replace rechargeable batteries that fail in materials or workmanship within specified warranty period.

1. Special Warranty Period for Batteries: Manufacturer's standard, but not less than 5 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for last four years.

C. Special Warranties for Fluorescent Ballasts: Written warranty, executed by manufacturer agreeing to replace fluorescent ballasts that fail in materials or workmanship within specified warranty period.

1. Special Warranty Period for Electronic Ballasts: Five years from date of manufacture, but not less than four years from date of Substantial Completion.

2. Special Warranty Period for Electromagnetic Ballasts: Manufacturers' standard warranty, but not less than two years from date of manufacture.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products indicated in the Lighting Fixture Schedule on the drawings.

2.2 FIXTURES AND FIXTURE COMPONENTS, GENERAL

A. Metal Parts: Free from burrs, sharp corners, and edges.

B. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.

C. Doors, Frames, and Other Internal Access: Smooth operating, free from light leakage under operating conditions, and arranged to permit relamping without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during relamping and when secured in operating position.

D. Reflecting Surfaces: Minimum reflectance as follows, unless otherwise indicated:

1. White Surfaces: 85 percent.

2. Specular Surfaces: 83 percent.

3. Diffusing Specular Surfaces: 75 percent.

4. Laminated Silver Metallized Film: 90 percent.

E. Lenses, Diffusers, Covers, and Globes: 100 percent virgin acrylic plastic or annealed crystal glass, unless otherwise indicated.

1. Plastic: High resistance to yellowing and other changes due to aging, exposure to heat, and ultraviolet radiation.

2. Lens Thickness: 0.15 inch minimum, unless greater thickness is indicated.

2.3 FLUORESCENT LAMP BALLASTS

A. General Requirements: Unless otherwise indicated, features include the following:

1. Designed for type and quantity of lamps indicated at full light output.

2. Total Harmonic Distortion Rating: Less than 20 percent.

3. Sound Rating: A.

B. Electronic Ballasts for Linear Lamps: Unless otherwise indicated, features include the following, besides those in "General Requirements" Paragraph above:

1. Certified Ballast Manufacturer Certification: Indicated by label.

2. Encapsulation: Without voids in potting compound.

3. Parallel Lamp Circuits: Multiple lamp ballasts connected to maintain full light output on surviving lamps if one or more lamps fail.

C. Ballasts for Compact Lamps in Recessed Fixtures: Unless otherwise indicated, additional features include the following:

1. Type: Electronic, fully encapsulated in potting compound.

2. Power Factor: 90 percent, minimum.

3. Operating Frequency: 20 kHz or higher.

4. Flicker: Less than 5 percent.

5. Lamp Current Crest Factor: Less than 1.7.

6. Transient Protection: Comply with IEEE C62.41 for Category A1 locations.

7. Interference: Comply with 47 CFR, Chapter 1, Part 18, Subpart C for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.

D. Ballasts for Compact Lamps in Nonrecessed Fixtures: Unless otherwise indicated, additional features include the following:

1. Power Factor: 90 percent, minimum.

2. Ballast Coil Temperature: 65 deg C, maximum.

3. Transient Protection: Comply with IEEE C62.41 for Category A1 locations.

4. Interference: Comply with 47 CFR, Chapter 1, Part 18, Subpart C for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.

E. Ballasts for Low-Temperature Environments: As follows:

1. Temperatures 0 Deg F (Minus 17 Deg C) and Above: Electronic type rated for 0 deg F (minus 17 deg C) starting temperature.

2. Temperatures Minus 20 Deg F (Minus 29 Deg C) and Above: Electromagnetic type designed for use with high-output lamps.

F. Ballasts for Low Electromagnetic Interference Environments: Comply with 47 CFR, Chapter 1, Part 18, Subpart C for limitations on electromagnetic and radio-frequency interference for consumer equipment.

2.4 HIGH-INTENSITY-DISCHARGE LAMP BALLASTS

A. General: Comply with ANSI C82.4. Unless otherwise indicated, features include the following:

1. Type: Constant wattage autotransformer or regulating high-power-factor type, unless otherwise indicated.

2. Operating Voltage: Match system voltage.

3. Minimum Starting Temperature: Minus 22 deg F (Minus 30 deg C) for single lamp ballasts.

4. Normal Ambient Operating Temperature: 104 deg F (40 deg C).

5. Open-circuit operation that will not reduce average life.

6. Auxiliary, Instant-on, Quartz System: Automatically switches quartz lamp on when fixture is initially energized and when momentary power outages occur. Automatically turns quartz lamp off when high-intensity-discharge lamp reaches approximately 60 percent light output.

B. Encapsulation: Manufacturer's standard epoxy-encapsulated model designed to minimize audible fixture noise.

2.5 EXIT SIGNS

A. General Requirements: Comply with UL 924 and the following:

1. Sign Colors and Lettering Size: Comply with authorities having jurisdiction.

B. Internally Lighted Signs: As follows:

1. Lamps for AC Operation: Light-emitting diodes, 70,000 hours minimum rated lamp life.

C. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.

1. Battery: Sealed, maintenance-free, nickel-cadmium type with special warranty.

2. Charger: Fully automatic, solid-state type with sealed transfer relay.

3. Operation: Relay automatically energizes lamp from unit when circuit voltage drops to 80 percent of nominal or below. When normal voltage is restored, relay disconnects lamps, and battery is automatically recharged and floated on charger.

2.6 EMERGENCY LIGHTING UNITS

A. General Requirements: Self-contained units. Comply with UL 924. Units include the following features:

1. Battery: Sealed, maintenance-free, lead-acid type with minimum 10-year nominal life and special warranty.

2. Charger: Fully automatic, solid-state type with sealed transfer relay.

3. Operation: Relay automatically turns lamp on when supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps, and battery is automatically recharged and floated on charger.

4. Wire Guard: Where indicated, heavy-chrome-plated wire guard arranged to protect lamp heads or fixtures.

5. Integral Time-Delay Relay: Arranged to hold unit on for fixed interval after restoring power after an outage. Provides adequate time delay to permit high-intensity-discharge lamps to restrike and develop adequate output.

2.7 EMERGENCY FLUORESCENT POWER SUPPLY UNIT

A. Internal Type: Self-contained, modular, battery-inverter unit factory mounted within fixture body. Comply with UL 924.

1. Test Switch and Light-Emitting Diode Indicator Light: Visible and accessible without opening fixture or entering ceiling space.

2. Battery: Sealed, maintenance-free, nickel-cadmium type with minimum 10-year nominal life.

3. Charger: Fully automatic, solid-state, constant-current type.

4. Operation: Relay automatically energizes lamp from unit when normal supply circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamp, and battery is automatically recharged and floated on charger.

2.8 LAMPS

A. Fluorescent Color Temperature and Minimum Color-Rendering Index: 3500 K and 85 CRI, unless otherwise indicated.

B. Noncompact Fluorescent Lamp Life: Rated average is 20,000 hours at 3 hours per start when used on rapid-start circuits.

C. Metal-Halide Color Temperature and Minimum Color-Rendering Index: 3600 K and 70 CRI, unless otherwise indicated.

2.9 FIXTURE SUPPORT COMPONENTS

A. Comply with Division 26 Section "Basic Electrical Materials and Methods," for channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch (12-mm) steel tubing with swivel ball fitting and ceiling canopy. Finish same as fixture.

C. Twin-Stem Hangers: Two, 1/2-inch (12-mm) steel tubes with single canopy arranged to mount a single fixture. Finish same as fixture.

D. Rod Hangers: 3/16-inch- (5-mm-) minimum diameter, cadmium-plated, threaded steel rod.

E. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

F. Aircraft Cable Support: Use cable, anchorages, and intermediate supports recommended by fixture manufacturer.

2.10 FINISHES

A. Fixtures: Manufacturer's standard, unless otherwise indicated.

1. Paint Finish: Applied over corrosion-resistant treatment or primer, free of defects.

2. Metallic Finish: Corrosion resistant.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Fixtures: Set level, plumb, and square with ceiling and walls, and secure according to manufacturer's written instructions and approved submittal materials. Install lamps in each fixture.

B. Support for Fixtures in or on Grid-Type Suspended Ceilings: Use grid for support.

1. Install a minimum of four ceiling support system rods or wires for each fixture. Locate not more than 6 inches (150 mm) from fixture corners.

2. Support Clips: Fasten to fixtures and to ceiling grid members at or near each fixture corner.

3. Fixtures of Sizes Less Than Ceiling Grid: Arrange as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch (20-mm) metal channels spanning and secured to ceiling tees.

C. Suspended Fixture Support: As follows:

1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.

2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.

3. Continuous Rows: Suspend from cable installed according to fixture manufacturer's written instructions and details on Drawings.

3.2 CONNECTIONS

A. Ground equipment.

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 FIELD QUALITY CONTROL

A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

B. Tests: As follows:

1. Verify normal operation of each fixture after installation.

2. Emergency Lighting: Interrupt electrical supply to demonstrate proper operation.

3. Verify normal transfer to battery source and retransfer to normal.

C. Malfunctioning Fixtures and Components: Replace or repair, then retest. Repeat procedure until units operate properly.

D. Corrosive Fixtures: Replace during warranty period.

3.4 CLEANING AND ADJUSTING

A. Clean fixtures internally and externally after installation. Use methods and materials recommended by manufacturer.

B. Adjust aimable fixtures to provide required light intensities.

END OF SECTION 26 51 00

DIVISION 26: ELECTRICAL
Section 27 05 25 - Communication and Data-Processing Equipment

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes wire, cable, connecting devices, installation, and testing for wiring systems to be used as signal pathways for voice and high-speed data transmission.

1.3 DEFINITIONS

A. EMI: Electromagnetic interference.

B. IDC: Insulation displacement connector.

C. LAN: Local area network.

D. PVC: Polyvinyl chloride.

E. STP: Shielded twisted pair.

F. UTP: Unshielded twisted pair.

1.4 SUBMITTALS

A. Product Data: Include data on features, ratings, and performance for each component specified.

B. Shop Drawings: Include dimensioned plan and elevation views of components.

1. System labeling schedules, including electronic copy of labeling schedules, as specified in Part 3, in software and format selected by Owner.

C. Product Certificates: Signed by manufacturers of cables, connectors, and terminal equipment certifying that products furnished comply with requirements.

D. Qualification Data: For firms and persons specified in "Quality Assurance" Article. Provide evidence of applicable registration or certification.

E. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

F. Maintenance Data: For products to include in maintenance manuals specified in Division 1.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: To be qualified to bid on this project, the contractor shall have successfully completed a minimum of five (5) projects for installation of fiber optic cable and a minimum of ten (10) projects for installation of Category 6 unshielded twisted pair cable.

B. Comply with NFPA 70.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.6 COORDINATION

A. Coordinate Work of this Section with Owner's telephone switch and LAN equipment suppliers. Coordinate service entrance arrangement with local exchange carrier.

1. Meet jointly with representatives of above organizations and Owner's representatives to exchange information and agree on details of equipment arrangements and installation interfaces.
2. Record agreements reached in meetings and distribute record to other participants.
3. Adjust arrangements and locations of distribution frames and patch panels in equipment rooms and wiring closets to accommodate and optimize arrangement and space requirements of telephone switch and LAN equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cable:

a. Belden Wire & Cable Company.
b. Berk-Tek
c. Lucent Technologies, Inc.; Network Systems.
d. Siecor Corp.

2. Terminal and Connector Components and Distribution Racks:

a. AMP, Inc.
b. Chatsworth
c. Hubbell Premise Wiring, Inc.
d. Leviton Mfg. Co., Inc.; Telcom Division.
e. Lucent Technologies, Inc.; Network Systems.
f. Ortronics
g. Siecor Corp.

2.2 SYSTEM REQUIREMENTS

A. General: Coordinate the features of materials and equipment so they form an integrated system. Match components and interconnections for optimum future performance.

B. Expansion Capability: Unless otherwise indicated, provide spare positions in patch panels and space in backbone cable trays and wireways to accommodate 20 percent future increase in active workstations.

C. The cabling system shall allow the owner to transmit up to speeds of 100 Mbs plus.

2.3 MOUNTING ELEMENTS

A. Ladder Rack: Provide 12" wide ladder style tray with 1-½" side rails and 9" rung spacing in the MDF room. As manufactured by Chatsworth or equal.

B. Raceways and Boxes: Comply with Division 26 Section "Raceways and Boxes."

C. Vertical Cable Management Rails: Rails shall be 6’ high, 6” wide with rungs on front and rear and shall be as manufactured by CTI or equal.

D. Rack Mounted Plugmold: Plugmold shall be 6’ long with 12 outlets, each on 5.25” centers, and a 15’ cord. Plugmold shall be Wiremold or equal.

E. Distribution Racks: Freestanding aluminum units or wall mounted cabinets as indicated designed for telecommunications terminal support and coordinated with dimensions of units to be supported. Chatsworth or equal.

1. Approximate Module Dimensions: 84 inches high by 19 inches wide.
2. Finish: Baked-polyester powder coat.
3. Securely bolt to floor.

2.4 TWISTED-PAIR CABLES, CONNECTORS, AND TERMINAL EQUIPMENT

A. Listed as complying with Categories 6 of EIA/TIA-568-A.

B. Conductors: Solid copper.

C. UTP Cable: Comply with EIA/TIA-568-B. Four thermoplastic-insulated, individually twisted pairs of conductors; No. 24 AWG, color-coded; data cables enclosed in orange PVC jacket and voice cables in a blue PVC jacket. Berk-Tek or equal.

D. UTP Cable Connecting Hardware: Comply with EIA/TIA-568-B. IDC type, using modules designed for punch-down caps or tools.

1. IDC Terminal Block Modules: Integral with connector bodies, including plugs and jacks where indicated.
2. IDC Connecting Hardware: Consistent throughout Project.

E. Patch Panel: Modular panels housing multiple, numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables. Equal to 48 port patch panel by Ortronics.

1. Number of Jacks per Field: One for each four-pair conductor group of indicated cables, plus spares and blank positions adequate to satisfy specified expansion criteria.
2. Mounting: Rack.

F. Jacks and Jack Assemblies for UTP Cable: Modular, color-coded, RJ-45 receptacle units with integral IDC-type terminals. Use keyed jacks for data service. As manufactured by Ortronics or equal.

G. Workstation Outlets: Dual jack-connector assemblies mounted in single or multigang faceplate.

1. Faceplate: Stainless steel.
2. Mounting: Flush, unless otherwise indicated.
3. Legend: Factory label by silk-screening or engraving.

2.5 FIBER-OPTIC CABLES, CONNECTORS, AND TERMINAL EQUIPMENT

A. Cables: Factory fabricated, jacketed, low loss, glass type, fiber optic, single mode as manufactured by Corning or equal.

1. Backbone, Strands per Cable: See drawings.

B. Cable Connectors: LC connectors as manufactured by Ortronics or equal.

C. Patch Panel: Modular panels housing multiple-numbered duplex cable connectors. As manufactured by Ortronics or equal.

1. Permanent Connection: Permanently connect one end of each connector module to installed cable fiber.
2. Number of Connectors per Field: One for each fiber of cable or cables assigned to field, plus spares and blank positions adequate to satisfy specified expansion criteria.
3. Mounting: Rack.

2.6 IDENTIFICATION PRODUCTS

A. Comply with Division 26 Section "Basic Electrical Materials and Methods" and the following:

1. Cable Labels: Self-adhesive vinyl wraparound tape markers, machine printed with alphanumeric cable designations.

PART 3 - EXECUTION

3.1 GENERAL

A. All fiber optic and Category 6 cable, data jacks and faceplates, patch panels, MDF/IDF frames or cabinets, outlet boxes, conduit, cable support hardware, sleeves, etc. as required to complete the installation described in these specifications and the drawings shall be supplied and installed by this contractor.

3.2 EXAMINATION

A. Examine pathway elements intended for cable. Check raceways, cable trays, and other elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions affecting installation. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 APPLICATION OF MEDIA

A. Backbone Cable for Data Service: Use fiber-optic cable for runs between equipment rooms and wiring closets and for runs between wiring closets.

B. Horizontal Cables for Data Service: Use UTP cable complying with Category 6 of EIA/TIA-568-A for runs between wiring closets and workstation outlets.

C. Horizontal Cables for Voice Service: Use UTP cable complying with Category 6 of EIA/TIA-568-A for runs between wiring closets and workstation outlets.

3.4 CATEGORY 6 CABLE INSTALLATION

A. Wiring Method: Install wiring in raceway and cable tray except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces where cable wiring method may be used. Use UL-listed plenum cable in environmental air spaces, including under raised access flooring and plenum ceilings. Conceal raceway and wiring except in unfinished spaces.

B. Install cable using techniques, practices, and methods that are consistent with Category 6 rating of components and that ensure Category 6 performance of completed and linked signal paths, end to end.

C. Install cable without damaging conductors, shield, or jacket.

D. Do not bend cable in handling or in installing to smaller radii than minimums recommended by manufacturer.

E. Pull cables without exceeding cable manufacturer's recommended pulling tensions.

1. Pull cables simultaneously if more than one is being installed in the same raceway.
2. Use pulling compound or lubricant if necessary. Use compounds that will not damage conductor or insulation.
3. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage media or raceway.

F. Install exposed cable parallel and perpendicular to surfaces or exposed structural members, and follow surface contours where possible.

G. Secure and support cable at intervals not exceeding 48 inches with J-hooks or cable tray and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.

H. Wiring within Wiring Closets and Enclosures: Provide adequate length of conductors. Train conductors to terminal points with no excess. Use lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.

I. Separation of Wires: Comply with EIA/TIA-569 rules for separating unshielded copper communication and data-processing equipment cables from potential EMI sources, including electrical power lines and equipment.

J. Cables shall be routed in groups of similar types. (i.e. data outlet cables grouped together, fiber optic cables grouped together, etc.)

K. Horizontal cabling routed above ceilings shall be supported using the following methods.

1. Cables supported on J-hooks designed specifically for this purpose. Support J-hooks from structure with threaded rod. Hang J-hooks approximately two feet above the lay-in ceiling.
2. Cables independently supported using cabling clips attached to the ceiling structure or slab.

L. All cable shall be neatly routed along one side of the corridor. Branch out across the corridors as necessary to serve the individual rooms. Cabling shall be routed in a manner which will allow the owner to maintain access to the cables, electrical systems and HVAC equipment above the ceiling. Maintainability of all systems above the ceiling is critical.

M. All cables shall be bundled and wrapped together with velcro straps. Strapping shall occur on four foot intervals throughout the space. Straps should not bite into the cable, but should form loosely around the cables as not to depress the cable.

N. Cables above the corridor ceiling shall be supported using cable tray and wall mounted J-hooks equal to Caddy CAT32 with any necessary attachment hardware.

O. Cables shall be routed into conduits stubbed up above the ceiling from each outlet (bushing on end of conduit). Cabling shall be routed in conduit above non-accessible ceilings.

P. All cables shall pass acceptable test requirements and levels as detailed in the “Field Quality Control” section of these specifications. Contractor to remedy any cabling problems or defects in order to pass or comply with testing. This includes terminations and the re-pull on new cable as required at no additional cost to the owner.

Q. Cables shall not be spliced.

R. Ends of cables shall be terminated by the contractor on both ends unless otherwise noted.

S. Provide proper temporary protection of cable after pulling is complete before final dressing and terminations are complete. Do not leave cable laying on floor. Bundle and tie wrap up off of the floor.

T. Contractor shall insure that cabling is a minimum of 5" away from all light fixtures.

U. Contractor shall install sleeves with bushings as necessary in walls for routing cables to the outlets. Install a minimum of three (3) 3" sleeves with bushings for the MDF. Firestop all firewall penetrations.

V. When cables turn down below ceiling at the MDF/IDF, contractor shall install sleeves through the lay-in ceiling (bushing on each end). Cutting a hole in the ceiling tile is not acceptable.

W. Install a J-hook directly above the drop to every outlet. Bundle and tie wrap up 5' of slack cable prior to entering the wall.

X. Cable Terminations

1. Terminations shall be made in accordance with EIA TIA 568B standard.
2. Terminations shall be RJ45 type.
3. Route individual four pair category 6 cable to the backside of each patch panel and punch down onto a port. Label each port on the front and rear of each panel.
4. Maintain twists of each pair to the punch down point. Do not strip more than one-half inch of insulation from the cable at termination points.

Y. Outlets

1. Install outlets per manufacturer's instructions and recommendations.
2. Install and terminate all UTP cabling at each outlet as per manufacturer's instructions and recommendations.
3. Provide an outlet label on each cover plate and inside each wall box.
4. Leave at least 12" of slack cable at each outlet.

3.5 FIBER OPTIC INSTALLATION

A. Fiber optic cable shall be installed inside buildings using the same methods as twisted pair; however, the following guidelines should be observed:

1. Do not exceed maximum pulling tension.
2. Do not exceed minimum installed and long term bend radius.
3. Avoid sharp bends and corners.
4. Provide additional crush/mechanical protection in high risk environments.
5. Do not exceed maximum vertical rise specification unless intermediate tension relief is used.
6. Observe all governing building and fire codes (either by using a properly listed cable or suitable raceway).
7. Do not deform the cable jacket, specifically when using cable fasteners or ties.
8. All fiber optic cabling shall be routed in EMT. Install an extra pull string in all conduit.

B. When installing fiber optic cable in vertical runs, the following special guidelines should be observed:

1. Work from the top down, when possible.
2. Install intermediate split wire mesh grip(s) wherever the maximum vertical rise is exceeded.
3. Secure the cable in the riser wiring closets with cable ties or straps as needed to prevent accidental damage to cable.

C. When installing fiber optic cable, the following guidelines should be observed at termination and splice points:

1. The amount of cable slack at termination points should allow the cable to be routed to the termination location with enough additional cable to reach a convenient location for the polishing, plus an additional ten feet.
2. Fiber optic warning signs should be placed on all conduits containing fiber optic cable. Warning signs can help prevent damage resulting from the cable being mistaken for something else. Install signs at each end of the cable and every 20 feet in between.

D. When pulling fiber optic cable, the following guidelines should be observed:

1. Yellow pulling compound should be used if making long or difficult pulls to reduce cable drag.

2. When pulling fiber optic cable by any mechanical device (winch, etc.) A dynameter must be used to ensure the maximum tensile strength is not exceeded.
3. The mechanical pulling device will be equipped with clutches or shear pins to ensure this.
4. The fiber cable will be attached to the pull line via the strength member or mesh grip.

E. Provide labeling of each cable indicating ‘TO’ and ‘FROM’ information.

F. Bring fiber optic cables into patch panels or cabinets at one location. Innerduct around cables shall extend to patch panel or cabinet entrance. Secure cables inside patch panel or cabinet at entrance point by tying the fiber jacket and/or strength members. Break out individual fiber cables inside of panel or cabinet. Coil up approximately 6 feet of spare cable before applying connector.

G. Cable Terminations

1. Terminations shall be LC type and shall be installed per the manufacturer’s instructions onto each individual strand of fiber optic cable and shall be terminated on the backside of the fiber optic patch panel.

3.6 GROUNDING

A. Comply with Division 26 Section "Grounding."

B. Ground cable shields, drain conductors, and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.

C. Bond shields and drain conductors to ground at only one point in each circuit.

D. Signal Ground Terminal: Locate in each equipment room and wiring closet. Isolate from power system and equipment grounding.

E. Signal Ground Bus: Mount on wall of main equipment room with standoff insulators.

F. Signal Ground Backbone Cable: Extend from signal ground bus to signal ground terminal in each wiring closet and equipment room.

3.7 INSTALLATION IN EQUIPMENT ROOMS AND WIRING CLOSETS

A. Mount patch panels and other connecting hardware on racks, unless otherwise indicated.

B. Group connecting hardware for cables into separate logical fields.

C. Use patch panels to terminate cables entering the space, unless otherwise indicated.

3.8 IDENTIFICATION

A. Identify system components complying with applicable requirements in Division 26 Section "Basic Electrical Materials and Methods" and the following Specifications.

B. General

1. All labels shall have an adhesive backing for permanent attachment.

2. All labels shall be of sufficient size. Minimum size shall be 1½" W x 3/16" H for outlets, outlet cables and patch panels.

C. Installation

1. Install labels straight.
2. Install labels at locations previously specified and as follows:

a. Outlet faceplates.
b. Inside of outlet box.
c. Outlet cable inside box.
d. Outlet cable in ceiling above outlet.
e. Outlet cable at rear of patch panel.
f. Fiber optic cable at patch panels.
g. Front and rear of patch panels.
h. 66 blocks at TBB

D. Text Size and Information

1. Text shall be as large and bold as possible.
2. All outlets and outlet cables shall contain the outlet number, room number, MDF/IDF number, patch panel number and port number.

E. Within Connector Fields, in Wiring Closets and Equipment Rooms: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both communication and data-processing equipment, use a different color for jacks and plugs of each service.

F. Cables, General: Label each cable within 4 inches (100 mm) of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.

G. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet (4.5 m).

H. Cable Schedule: Post in prominent location in each wiring closet and equipment room. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Provide electronic copy of final comprehensive schedules for Project, in software and format selected by Owner.

3.9 FIELD QUALITY CONTROL

A. General

1. The following cabling systems shall be tested after installation is fully completed.

a. Data outlet cabling from each outlet to the patch panel port, including test patch cables.
b. Fiber optic cabling from the IDF's to the MDF. All strands shall be tested.

2. Testing shall follow EIA TIA 568, TSB 36 and TSB 40 standards.

B. Testing: On installation of cable and connectors, demonstrate product capability and compliance with requirements. Test each signal path for end-to-end performance from each end of all pairs installed. Remove temporary connections when tests have been satisfactorily completed.

1. Copper Cable Procedures: Inspect for physical damage and test each conductor signal path for continuity and shorts. Use Class 2 bidirectional Category 6 tester. Test for faulty connectors, splices, and terminations. Test according to EIA/TIA-TSB 67, "Transmission Performance Specifications for Field Testing of Unshielded Twisted-Pair Cabling Systems." Link performance for UTP cables must meet minimum criteria of EIA/TIA-568-A.
2. Fiber-Optic Cable Procedures: Perform each visual and mechanical inspection and electrical test, including optional procedures, stated in NETA ATS, Section 7.25. Certify compliance with test parameters and manufacturer's written recommendations. Test optical performance with optical power meter capable of generating light at all appropriate wavelengths.

C. Category 6 Cable Testing

1. Cable testing shall be performed with a Micro-Test Pentascanner Plus or equivalent test unit. Test unit shall be capable of providing a Level 2 accuracy test and have a category 6 printout.
2. Each outlet/cable shall be tested and certified. Each pair of the end to end system shall be tested. End to end is from the outlet RJ45 port through the RJ45 port at the Category 6 data patch panel. A 10' patch cable shall be used at the patch panel end and a 3' patch cable shall be used at the outlet end so that the outlet, outlet termination, cable, patch panel termination, patch cables and patch panel port can be seen in the test.
3. Test results shall be positive and favorable. End to end attenuation loss and near end cross talk shall meet or exceed category 6, EIA/TIA 568, TSB 36 requirements.
4. If a problem or failed test occurs, the contractor shall evaluate and remedy the problem. After a problem has been remedied, the contractor shall re-test the circuit and analyze test results. The contractor shall continue this process until the cable passes all tests.
5. Each outlet/cable test shall include:

    a. Overall cable length
    b. System continuity
    c. Proper connectivity
    d. Open pairs
    e. Short circuits
    f. Reversed pairs
    g. EMI noise induction
    h. Damaged cable
    i. Stretched, chinked or crimped cable
    j. Attenuation loss in dB
    k. Near end cross talk in dB
6. Provide the owner with three (3) copies of the test units results for all cables.

D. Fiber Optic Cable Testing

1. The fiber cables shall be tested in both directions.
2. All test results shall be in writing giving all readings, date, tested by, and totals.
3. All testing shall be performed by using an Optical Power Meter (Wilcom Model T339 or approved equivalent).
4. Each strand shall be tested and the following information be turned over to the owner in chart form:

    a. From Point to Point
    b. Fiber I.D. Label No.
    c. RX Level
    d. Attenuation Total
    e. Wave Length
    f. Reference Level

5. Each strand shall not exceed a level of 3.0db of attenuation.

E. Correct malfunctioning units at project site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units and retest.

3.10 CLEANING

A. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions.

3.11 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain systems.

1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment and schedules.
2. Train designated personnel in cable-plant management operations, including changing signal pathways for different workstations, rerouting signals in failed cables, and extending wiring to establish new workstation outlets.
3. Review data in maintenance manuals. Refer to Division 1 Section "Contract Closeout."
4. Schedule training with Owner, through Architect, with at least seven days' advance notice.

END OF SECTION 27 05 25

SECTION 31 10 00
SITE CLEARING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Clearing of vegetation, trees, landscaping and other vegetation

B. Clearing of stumps, roots, shrubs, brush, grass , and organic material

C. Removal of existing debris, junk, and trash from site.

D. Stripping Topsoil

1.02 RELATED REQUIREMENTS

A. Section 01 5713 - Temporary Erosion and Sediment Control.

B. Section 01 7000 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products.

C. Section 01 7419 - Construction Waste Management and Disposal: Limitations on disposal of removed materials; requirements for recycling.

D. Section 02 4100 - Demolition: Removal of built elements and utilities.

E. Section 31 2200 - Grading: Topsoil removal.

F. Section 31 2200 - Grading: Fill material for filling holes, pits, and excavations generated as a result of removal operations. Topsoil removal.

G. Section 31 2323 - Fill: Fill material for filling holes, pits, and excavations generated as a result of removal operations.

H. Section 31 2323 - Fill: Filling holes, pits, and excavations generated as a result of removal operations.

PART 2 PRODUCTS

2.01 MATERIALS

A. Fill Material: As specified in Section 31 2323 - Fill and Backfill

B. Topsoil: See Section 31 2323.

PART 3 EXECUTION

3.01 SITE CLEARING

A. Minimize production of dust due to clearing operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.

B. Provide traffic control and when working near or adjacent to open roads, streets, walks, etc.

C. Provide temporary construction barricades to as needed to separate the work zone from open facilities and the public.

D. Do not close streets or sidewalks without permission from authority having jurisdiction.

E. Protect existing improvements to remain and adjacent properties from damage.

F. Restore damaged improvements and adjoining properties as acceptable to party having jurisdiction and at no cost to the owner.

G. Dewater low areas prior to clearing and stripping topsoil.

H. Strip topsoil to whatever depth encountered on site. Prevent intermingling of topsoil to be reused with underlying subsoil or other objectionable material.

I. Strip and stockpile topsoil as needed for reuse on site in landscaped, grassed, and seeded areas.

J. Topsoil stockpiles shall be free draining, covered or seeded if the stockpile shall not be reused in 13 days. Provide silt fencing around the perimeter of all stockpiles.

K. Fill holes, pits, and excavations generated as a result of clearing operations in accordance with Section 31 2200 - Grading and Sec31 2323 - Filling.

L. Remove other items elsewhere on site as indicated on drawings

M. Provide positive drainage as needed to keep the site in a dry condition.

3.02 EXISTING UTILITIES AND BUILT ELEMENTS

A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.

B. Protect existing utilities to remain from damage.

C. Do not disrupt public utilities without permit from authority having jurisdiction.

D. Protect existing structures and other elements that are not to be removed.

3.03 VEGETATION

A. Completely remove trees, stumps, roots, shrubs, brush, grass , and organic material in areas to be covered by buildings, structures, paving, lawns and landscaped areas.

B. Do not remove or damage vegetation beyond the limits indicated on drawings.

C. Do not burn, bury, landfill, or leave on site any trees, stumps, roots, shrubs, brush, grass, or organic material resulting from clearing operation.

D. Dead Wood: Remove all dead trees (standing or down), limbs, and dry brush on site; treat as specified for vegetation removed.

E. Restoration: If vegetation outside removal limits or within specified protective fences is damaged or destroyed due to subsequent construction operations, replace at no cost to Owner.

3.04 DEBRIS AND DISPOSAL

A. Remove debris, junk, and trash from site.

B. Remove cleared trees, stumps, roots, shrubs, brush, grass , and organic material from site.

C. Leave site in clean condition, ready for subsequent work.

D. Clean up spillage and wind-blown debris from public and private lands.

E. Burning on site shall not be permitted.

F. Dispose of all excess topsoil, unsuitable material, and waste material off site in a legal manner.

END OF SECTION

SECTION 31 22 00
GRADING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Removal and storage of topsoil.

B. Rough grading and filling the site for site structures, building pads, and paving.

C. Finish grading.

1.02 RELATED REQUIREMENTS

A. Section 31 1000 - Site Clearing.

B. Section 31 2316 - Excavation.

C. Section 31 2316.13 - Trenching: Trenching and backfilling for utilities.

D. Section 31 2323 - Fill: Filling and compaction.

1.03 QUALITY ASSURANCE

A. Perform Work in accordance with State of Texas, Department of Transportation standards.

PART 2 PRODUCTS

2.01 MATERIALS

A. Topsoil: See Section 31 2323.

B. Fill Materials: See Section 31 2323.

C. Unsuitable Materials: Material defined as highly plastic soils, organic or material that will not provide a stable foundation or material that will not compact to the requirements set forth in these specifications or material not meeting the requirements of Section 31 2323.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that survey bench mark and intended elevations for the Work are as indicated.

B. Verify the absence of standing or ponding water.

C. It shall be the obligation of the Contractor to satisfy himself as to the accuracy of the topographic survey furnished on the grading plan by personal examination of the site and the existing conditions. If contractor disagrees with topographic survey, he must notify owner in advance of bidding or it is taken that contractor accepts topography.

3.02 PREPARATION

A. Identify required lines, levels, contours, and datum.

B. Stake and flag locations of known utilities.

C. Locate, identify, and protect from damage above and below grade utilities to remain.

D. Notify utility company to remove and relocate utilities.

E. Protect site features to remain, including but not limited to bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs, from damage by grading equipment and vehicular traffic.

F. Do not perform grading operations during periods of wet weather when it would be impossible to control moisture of soils

G. Complete demolition and clearing operations in areas to be graded. Remove debris, roots, branches, and large rock.

H. Prior to grading lower areas perform the following:
   1. Drain water out by gravity with ditch having flow line lower than lowest elevation in low area. If drainage cannot be performed by gravity ditch, use adequate pump or any other measures necessary for drainage of site.
   2. After drainage of area is complete, remove muck, mud, debris, and other material of unsuitable nature by using acceptable equipment and methods that will keep natural soils underlying low area dry and undisturbed.

I. When rain is predicted, contractor shall roll graded areas to seal against infiltration. Contractor shall at all times keep site graded to maximize runoff in case of rain.

3.03 ROUGH GRADING

A. Remove topsoil from areas to be further excavated, re-landscaped, or re-graded, without mixing with foreign materials.

B. Do not remove topsoil when wet.

C. After grade has been an established in cut areas and prior to placement of fill in any fill areas, the exposed subgrade shall be carefully inspected by probing, proof rolling and testing as needed. Remove any topsoil, organic material, unsuitable material, wet, soft or loose soil and other undesirable material.

D. Contractor shall contact the testing representative to inspect proof rolling operations. All areas failing proof rolling shall be undercut to an unyielding subgrade.

E. Where low density soils and or highly plastic soils are encountered, as detected by proofrollimg the contractor shall undercut and replace with compacted structural fill.

F. Building pads and foundations shall be support on a minimum of 12" of structural fill. Structural fill shall extend 5 feet beyond the periphery of the buildings. Structural fill shall extend 3 feet beyond the paving limits. This requirement applies to both cuts and fills.

G. All cavities and irregularities shall be enlarged to permit use of compaction equipment for subsequent filling.

H. Scarify and recompact the top 8” of all areas to receive fill.

I. See Section 31 2323 for fill material, compaction and moisture content requirements..

J. Horizontally bench existing slopes greater than 1:4 to key fill material into existing slope for firm bearing.

K. Fill placement can proceed after the surface densification is accomplished and proof rolling is completed.

L. In areas where fill is to be placed on exiting steep cuts slopes, the exiting surface shall be horizontally benched the width of a piece of equipment prior to fill placement.

M. All fill shall be placed in lifts, moisture conditioned, and compacted

N. After excavations have been cut to subgrade, the subgrade areas shall be scarified to a minimum depth of 8 inches and re-compacted.

O. Grade areas to elevations or contours are indicated on Drawings. Refer to the drawings for thickness of pavements, concrete slabs, etc. to determine subgrade elevations. Refer to the architectural drawing for thickness floor slabs and granular support material.

P. If compaction requirements are not complied with at any time during construction process, remove and recompact deficient areas until proper compaction is obtained at no additional expense to Owner

Q. Refer to Section 31 2323 Filling for all material, lift thickness, compaction, and moisture requirements to include re-compact of scarified cuts exposed at grade.

R. Remove and replace soils deemed unsuitable by classification and which are excessively moist due to lack surface water control.

3.04 SOIL REMOVAL

A. Stockpile topsoil to be re-used on site; remove all excess topsoil from site.

B. All unsuitable material, and excess subsoil shall be removed from the site.

3.05 FINISH GRADING

A. Before Finish Grading:
   1. Verify building and trench backfilling have been inspected.
   2. Verify subgrade has been contoured and compacted.

B. Where topsoil is to be placed, scarify surface to depth of 2 inches.

C. Place topsoil to thickness 4 inches.

D. Place topsoil during dry weather.

E. Remove roots, weeds, rocks, and foreign material from topsoil while spreading.

F. Fine grade topsoil to eliminate uneven areas and low spots. Maintain profiles and contour of subgrade.

G. Roll placed topsoil.

H. Maintain stability of topsoil during inclement weather. Replace topsoil in areas where surface water has eroded thickness below specifications.

I. All fill shall be placed in lifts, moisture conditioned, and compacted

J. All excavations cut to subgrade shall be scarified to a minimum depth of 8 inches and re-compacted

K. Grade areas to elevations or contours are indicated on Drawings. Refer to the drawings for thickness of pavements, concrete slabs, etc. to determine subgrade elevations. Refer to the architectural drawing for thickness floor slabs and granular support material. Refer to site construction plans for pavement, sidewalks, and other slab on grade thickness.

L. Ditches and swales shall be graded to allow for proper drainage with no ponding.

M. If compaction requirements are not complied with at any time during construction process, remove and recompact deficient areas until proper compaction is obtained at no additional expense to Owner

N. Top Surface of Subgrade: Plus or minus 0.10 feet from required elevation.

O. Top Surface of Finish Grade: Plus or minus 0.05 feet from required elevation.

3.06 OFF-SITE CONSTRUCTION

A. It shall be understood that all work occurring off-site and on adjacent highways, roads, streets, or right-of-ways is to be constructed in accordance with latest edition of Standard Specifications of the Alabama Department of Transportation, and any local agency having jurisdiction. Also, this work shall be subject to their inspection, regulations, and acceptance.

B. All construction of highways or streets is to have appropriate signage and or barricades in accordance with traffic control manual and/or the Alabama Department of Transportation. Peak hour traffic is to be inconvenienced at an absolute minimum.

3.07 REPAIR AND RESTORATION

A. Existing Facilities, Utilities, and Site Features to Remain: If damaged due to this work, repair or replace to original condition.

3.08 FIELD QUALITY CONTROL

A. Independent Testing Laboratory, paid for by the contractor, shall perform construction testing on site as follows
   1. Fill Placed in Areas to be Paved: At least one compaction test for every 5,000 square feet of each 8" loose lift or layer.
   2. Fill Placed Under Building and Extending 10’ outside Exterior Building Line: At least one compaction test for every 2,500 square feet of each 8" loose lift or layer, a minimum of 3 test per lift.
   3. Inspect proof rolling operations of all cuts and fills.

B. The Independent Testing Laboratory shall prepare test reports that indicate test location, elevation data, and test results. Owner, Architect, Engineer and Contractor shall be provided with copies of reports within 24 hours of time test was performed.

C. In event that any test performed fails to meet these Specifications, owner and Contractor shall be notified immediately by the Independent Testing Laboratory.

D. Foundation excavations shall be inspected and tested for appropriateness of bearing capacity at the bottom of footing by the Independent Testing Laboratory.

E. All proof rolling operations shall be performed in the presence of the independent testing laboratory. The independent testing laboratory shall determine if the subgrade passes the proof rolling operation.

3.09 CLEANING

A. Remove unused stockpiled topsoil, subsoil, and excess material.

B. Grade stockpile area to prevent standing water.

C. Leave site clean and raked, ready to receive landscaping.

END OF SECTION

SECTION 31 23 16
EXCAVATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Excavating for building volume below grade, footings, slabs-on-grade, paving, site structures, and utilities within the building.

B. Trenching for utilities outside the building to utility main connections.

C. Temporary excavation support and protection systems.

1.02 RELATED REQUIREMENTS

A. Section 01 5713 - Temporary Erosion and Sediment Control: Slope protection and erosion control.

B. Section 01 7000 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring. General requirements for dewatering of excavations and water control.

C. Section 02 4100 - Demolition: Shoring and underpinning existing structures.

D. Section 31 1000 - Site Clearing: Vegetation and existing debris removal.

E. Section 31 2200 - Grading: Soil removal from surface of site.

F. Section 31 2200 - Grading: Grading.

G. Section 31 2316.13 - Trenching: Excavating for utility trenches outside the building to utility main connections.

H. Section 31 2323 - Fill: Fill materials, filling, and compacting.

I. Section 31 3700 - Riprap.

1.03 REFERENCE STANDARDS

A. 29 CFR 1926 - U.S. Occupational Safety and Health Standards; current edition.

1.04 PROJECT CONDITIONS

A. Verify that survey bench mark and intended elevations for the Work are as indicated.

PART 2 PRODUCTS

2.01 MATERIALS

A. Refer to Section 31 2323 for fill material requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that survey bench mark and intended elevations for the work are as indicated.

3.02 PREPARATION

A. Identify required lines, levels, contours, and datum locations.

B. See Section 31 1000 for clearing, grubbing, and removal of existing debris.

C. See Section 31 2200 for topsoil removal.

D. Locate, identify, and protect utilities that remain and protect from damage.

E. Notify utility company to remove and relocate utilities.

F. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

G. Protect plants, lawns, rock outcroppings, and other features to remain.

H. Grade top perimeter of excavation to prevent surface water from draining into excavation. Provide temporary means and methods, as required, to maintain surface water diversion until no longer needed, or as directed by Engineer.

3.03 TEMPORARY EXCAVATION SUPPORT AND PROTECTION

A. Excavation Safety: Comply with OSHA's Excavation Standard, 29 CFR 1926, Subpart P.

3.04 EXCAVATING

A. Excavate to accommodate new structures and construction operations.

B. Slope banks of excavations deeper than 4 feet to angle of repose or unless shored.

C. Do not interfere with 45 degree bearing splay of foundations.

D. Cut utility trenches wide enough to allow inspection of installed utilities.

E. Hand trim excavations. Remove loose matter.

F. Correct areas that are over-excavated and load-bearing surfaces that are disturbed; see Section 31 2323.

G. Provide temporary means and methods, as required, to remove all water from excavations until directed by Engineer. Remove and replace soils deemed suitable by classification and which are excessively moist due to lack of dewatering or surface water control.

3.05 SUBGRADE PREPARATION

A. See Section 31 2323 for subgrade preparation at general excavations.

B. See Section 31 2316.13 for subgrade preparation at utility trenches.

3.06 FILLING AND BACKFILLING

A. Do not fill or backfill until all debris, water, unsatisfactory soil materials, obstructions, and deleterious materials have been removed from excavation.

B. See Section 31 2323 for fill, backfill, and compaction requirements at general excavations.

C. See Section 31 2316.13 for fill, backfill, and compaction requirements at utility trenches.

D. See Section 31 2200 for rough and final grading and topsoil replacement requirements.

3.07 REPAIR

A. Correct areas that are over-excavated and load-bearing surfaces that are disturbed; see Section 31 2323.

3.08 FIELD QUALITY CONTROL

A. Refer to Section 31 2200 Grading

B. Refer to Section 31 2316.13 Trenching

C. Probe and visually inspection load-bearing excavated surfaces before placement of foundations.

D. The Independent Testing Laboratory, paid for by the contractor, shall prepare test reports that indicate test location, elevation data, and test results. Owner, Architect, Engineer and Contractor shall be provided with copies of reports within 24 hours of time test was performed.

3.09 PROTECTION

A. Divert surface flow from rains or water discharges from the excavation.

B. Prevent displacement of banks and keep loose soil from falling into excavation; maintain soil stability.

C. Protect open excavations from rainfall, runoff, freezing groundwater, or excessive drying so as to maintain foundation subgrade in satisfactory, undisturbed condition.

D. Protect bottom of excavations and soil adjacent to and beneath foundation from drainage, rain and freezing.

E. Keep excavations free of standing water and completely free of water during concrete placement.

END OF SECTION

SECTION 31 23 23
FILL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Filling, backfilling, and compacting for footings, slabs-on-grade, paving, site structures, and buildings.

B. Backfilling and compacting for utilities outside the building to utility main connections.

C. Filling holes, pits, and excavations generated as a result of removal (demolition) operations.

1.02 RELATED REQUIREMENTS

A. Section 01 5713 - Temporary Erosion and Sediment Control: Slope protection and erosion control.

B. Section 31 2200 - Grading: Placement of on site and borrow material.

C. Section 31 2200 - Grading: Site grading.

D. Section 31 2316 - Excavation: Placement of on site and borrow material.

E. Section 31 2316.13 - Trenching: Excavating for utility trenches outside the building to utility main connections.

F. Section 31 3700 - Riprap.

1.03 DEFINITIONS

A. Finish Grade Elevations: Indicated on drawings.

B. Unsuitable Materials: Material defined as highly plastic soils, organic or material that will not provide a stable foundation or material that will not compact to the requirements set forth in these specifications or material not meeting the requirements of this Section.

1.04 REFERENCE STANDARDS

A. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)); 2012.

B. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2011.

C. ASTM D4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils; 2010.

1.05 SUBMITTALS

A. Soil Samples: 10 pounds sample of each type of fill; submit in air-tight containers to testing laboratory.

B. Materials Sources: Submit name of imported materials source.

C. Fill Composition Test Reports: Results of laboratory tests on proposed and actual materials used.

D. Compaction Density Test Reports.

PART 2 PRODUCTS

2.01 FILL MATERIALS

A. On site materials are generally considered acceptable as fill. On site materials failing to meet the requirements of structural fill are not acceptable as fill.

B. Structural Fill: On Site and Borrow Material.
   1. Free of organic matter and debris

2. Free of rocks larger than 2 inches.
3. Refer to Site Preparation Notes on the site plans.
4. Material imported from off site shall meet the geotechnical requirements and specifications as defined in the construction documents and geotechnical report for the project.

C. Concrete for Fill: Lean concrete.

D. Topsoil: Topsoil excavated on-site and Friable loam; imported borrow.
1. Free of roots, rocks larger than 1/2 inch, subsoil, debris, large weeds and foreign matter.
2. Acidity range (pH) of 5.5 to 7.5.
3. Containing a minimum of 4 percent and a maximum of 25 percent inorganic matter.
4. Complying with ASTM D2487 Group Symbol OH.

2.02 SOURCE QUALITY CONTROL

A. Where fill materials are specified by reference to a specific standard, test and analyze samples for compliance before delivery to site.

B. If tests indicate materials do not meet specified requirements, change material and retest.

C. Provide materials of each type from same source throughout the Work.

PART 3 EXECUTION

3.01 EXAMINATION

A. Identify required lines, levels, contours, and datum locations.

B. Verify areas to be filled are not compromised with surface or ground water.

3.02 PREPARATION

A. All fill areas shall scarified and recompacted prior to proof rolling.

B. After recompaction is achieved, the area shall be proof rolled in the presence of the qualified testing agency.

C. Proof rolling shall be performed in the presence of an independent testing laboratory representative.

D. Prior to placing fill, any area failing proof roll shall be undercut and backfilled with Structural Fill meeting the project specifications.

E. Compact subgrade to density equal to or greater than requirements for subsequent fill material.

F. Until ready to fill, maintain excavations and prevent loose soil from falling into excavation.

3.03 FILLING

A. Fill to contours and elevations indicated using unfrozen materials.

B. Employ a placement method that does not disturb or damage other work.

C. In areas where fill is to be placed on exiting steep cuts slopes, the exiting surface shall be horizontally benched the width of a piece of equipment prior to fill placement.

D. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.

E. Place fill in 6" compacted lifts or as defined by the geotechnical recommendations and construction documents.

F. Maintain optimum moisture content of fill materials to attain required compaction density.

G. Structural Fill: Place and compact material in equal continuous layers not exceeding 8 inches loose depth.

H. When insufficient material exist on site, provide borrow material meeting the requirements for structural fill.

I. Excess material shall be disposed of off site, or as directed by the owner.

J. Correct areas that are over-excavated.

K. Compaction Density are as follows:
   1. Fills shall be compacted to a minimum of 98% of the maximum dry density as defined by ASTM D698 at all location and all depths
   2. Where stabilizing agents are used compact to 100% of the maximum dry density as defined by ASTM D698.

L. Moisture requirements are as follows:
   1. Refer to Site Preparation Notes on the site plans.

M. Reshape and re-compact fills subjected to vehicular traffic.

N. Maintain temporary means and methods, as required, to remove all water while fill is being placed as required, or until directed by the geotechnical engineer. Remove and replace soils deemed unsuitable by classification and which are excessively moist due to lack of dewatering or surface water control.

3.04 TOLERANCES

A. Top Surface: Plus or minus 1 inch from required elevations.

3.05 FIELD QUALITY CONTROL

A. Refer to Section 2200 Grading for additional Field Quality Control requirements.

B. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D698 ("standard Proctor").

C. If tests indicate work does not meet specified requirements, remove work, replace and retest.

3.06 CLEANING

A. Remove unused stockpiled materials, leave area in a clean and neat condition.

B. Stabilize and leave free draining any borrow area, if used.

END OF SECTION

DIVISION 31 00 00: EARTHWORK
Section 31 31 16: Termite Control

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and any general provisions of the Contract for each Prime Contract, including General and Supplementary Conditions and specific requirements apply to this Section

1.2 SUMMARY

A. This Section includes soil treatment for termite control at all areas constructed on grade.

1.3 SUBMITTALS

A. General: Submit the following according to Conditions of Contract.

B. Product data and application instructions.

C. Certification that products used comply with U.S. Environmental Protection Agency (EPA) regulations for termiticides.

1.4 QUALITY ASSURANCE

A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for preparing substrate and application.

B. Engage a professional pest control operator who is licensed according to regulations of governing authorities to apply soil treatment solution.

C. Use only termiticides that bear a federal registration number of the EPA and are approved by local authorities having jurisdiction.

1.5 JOB CONDITIONS

A. Restrictions: Do not apply soil treatment solution until excavating, filling, and grading operations are completed, except as otherwise required in construction operations.

B. To ensure penetration, do not apply soil treatment to frozen or excessively wet soils or during inclement weather. Comply with handling and application instructions of the soil toxicant manufacturer.

1.6 WARRANTY

A. Warranty: Furnish written warranty, executed by Applicator and General Contractor, certifying that applied soil termiticide treatment will prevent infestation of subterranean termites. If subterranean termite activity is discovered during warranty period, General Contractor will re-treat

soil and repair or replace damage caused by termite infestation.

B. Warranty Period: 5 years from date of Final Acceptance.

C. The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the General Contractor under requirements of the Contract Documents.

PART 2 - PRODUCTS

2.1 SOIL TREATMENT SOLUTION

A. General: Use an emulsible, concentrated termiticide that dilutes with water, specially formulated to prevent termites infestation. Fuel oil will not be permitted as a diluent. Provide a solution consisting of one of following chemical elements.

B. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

1. Subject to compliance with requirement, provide Dominion 2L , Premice 2, Phantom, or Taurus SC Termiticide / Insecticide or approved equivalent.

C. Dilute with water to concentration level recommended by manufacturer.

D. Other solutions may be used as recommended by Applicator if approved for intended application by local authorities having jurisdiction. Use only soil treatment solutions that are not harmful to plants.

PART 3 - EXECUTION

3.1 APPLICATION

A. Surface Preparation: Remove foreign matter that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated, except previously compacted areas under slabs and foundations. Toxicants may be applied before placing compacted fill under slabs if recommended by toxicant manufacturer.

B. Application Rates: Apply soil treatment solution as follows:

1. Under slab-on-grade structures, treat soil before concrete slabs are placed, using the following application rates:

a. Apply 4 gallons of chemical solution per 10 linear feet to soil in critical areas under slab, including entire inside perimeter of foundation walls, along both sides of interior partition walls, around plumbing pipes and electric conduit penetrating slab, and around interior column footers.
b. Apply 1 gallon of chemical solution per 10 sq. ft. as an overall treatment under slab and attached slab areas where fill is soil or unwashed gravel. Apply 1-1/2 gallons of chemical solution to areas where fill is washed gravel or other coarse absorbent material.

c. Apply 4 gallons of chemical solution per 10 linear feet of trench for each foot of depth from grade to footing, along outside edge of building. Dig a trench 6 to 8 inches wide along outside of foundation to a depth of not less than 12 inches. Punch holes to top of footing at not more than 12 inches o.c. and apply chemical solution. Mix chemical solution with the soil as it is being replaced in the trench.

C. Post signs in areas of application to warn workers that soil termiticide treatment has been applied. Remove signs after areas are covered by other construction.

D. Reapply soil treatment solution to areas disturbed by subsequent excavation, landscape grading, or other construction activities following application.

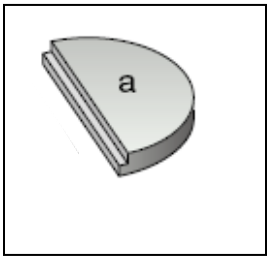
END OF SECTION 31 31 16

INSTALLATION AND SPECIFICATION PAGE FOR FIRE ROCK FIRE RING

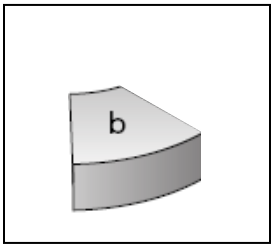
Site Preparation:

- Generally, a concrete pad 4 – 6 inches thick with footings as dictated by local building codes, is the best surface on which to erect any fire feature.
- With proper ground preparation, such as the gravel and sand layering under a paver patio, a Fire Rock Fire Ring may be installed without a concrete foundation.
- If it is your intention to install this product on a combustible surface (wooden deck), take extra precautions to insulate the surface under and surrounding the Fire Ring so that neither heat transference nor sparks present a hazard.

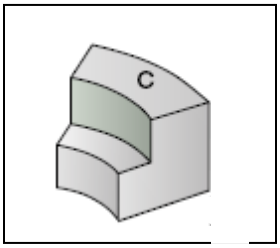
Center Base



Riser Block



Fire Ring Block



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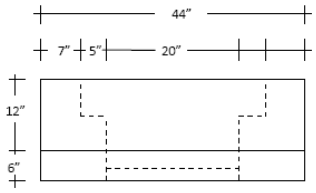
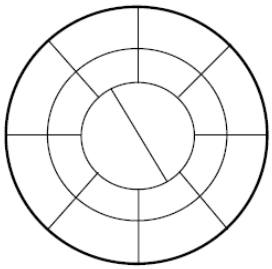
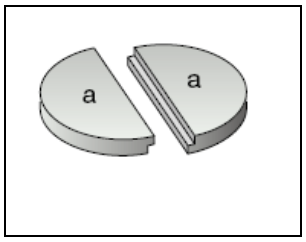
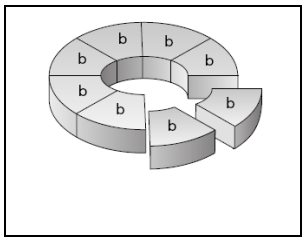






Step 1



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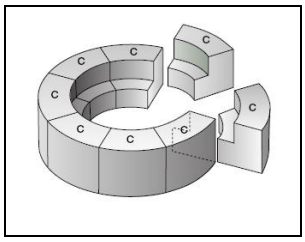

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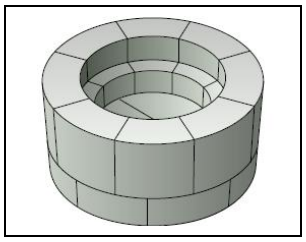

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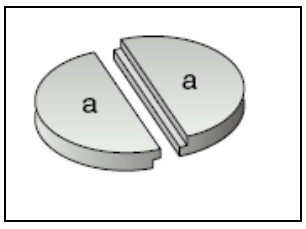
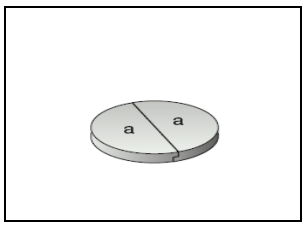
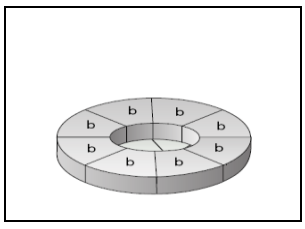
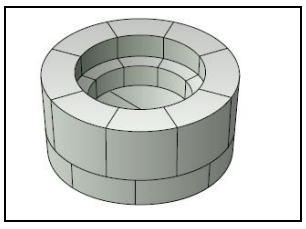








Each surface connecting with another surface must be generously covered with Fire Rock Adhesive Mortar.

FIREROCK
BUILDING MATERIALS

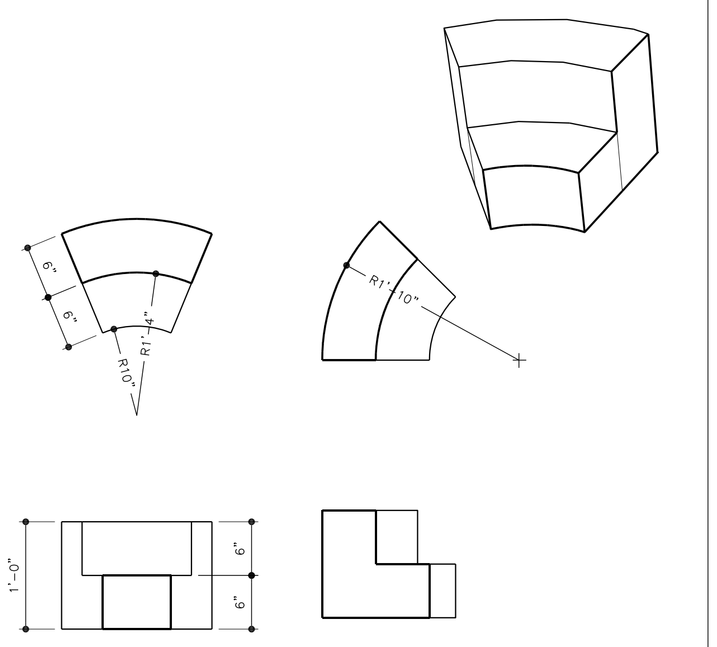
FireRock Building Materials
205.639.5000
Toll Free: 888.876.1025
Fax: 888.886.3473

MANUFACTURING:
3620 AVENUE C
FAIRFIELD, AL 35064

ADMINISTRATIVE:
1500 1st AVENUE N, #75
BIRMINGHAM, AL 35203

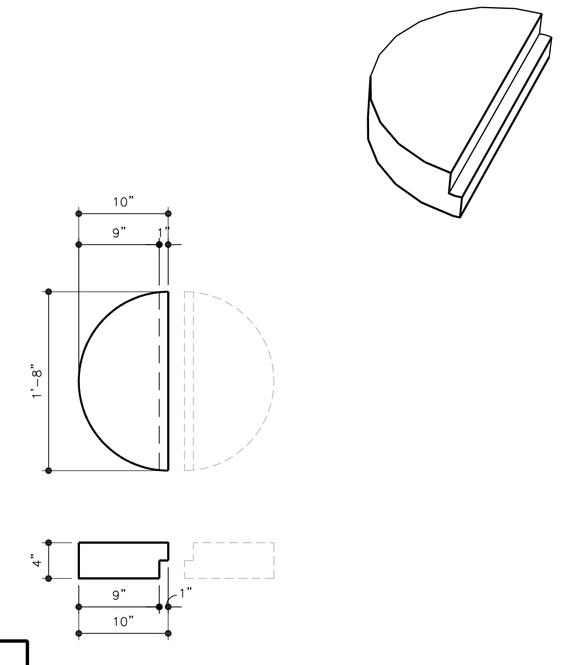
FireRock
The fireplace, *rekindled.*

ROUND FIRE RING

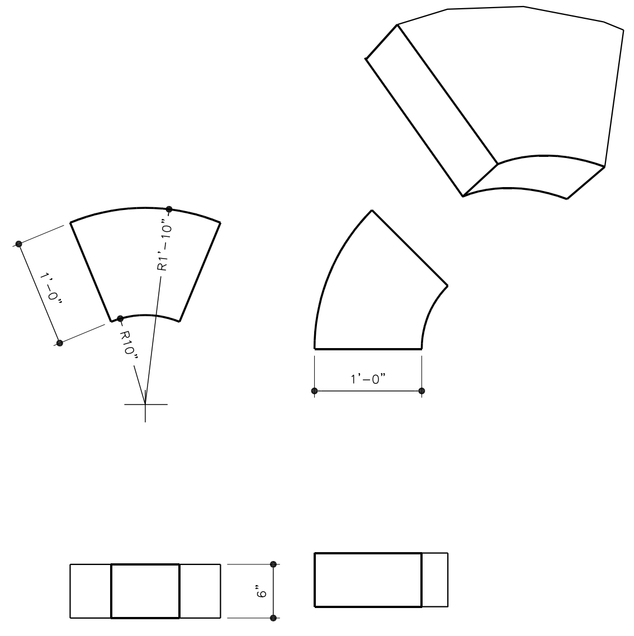


3 UNIT BLOCK

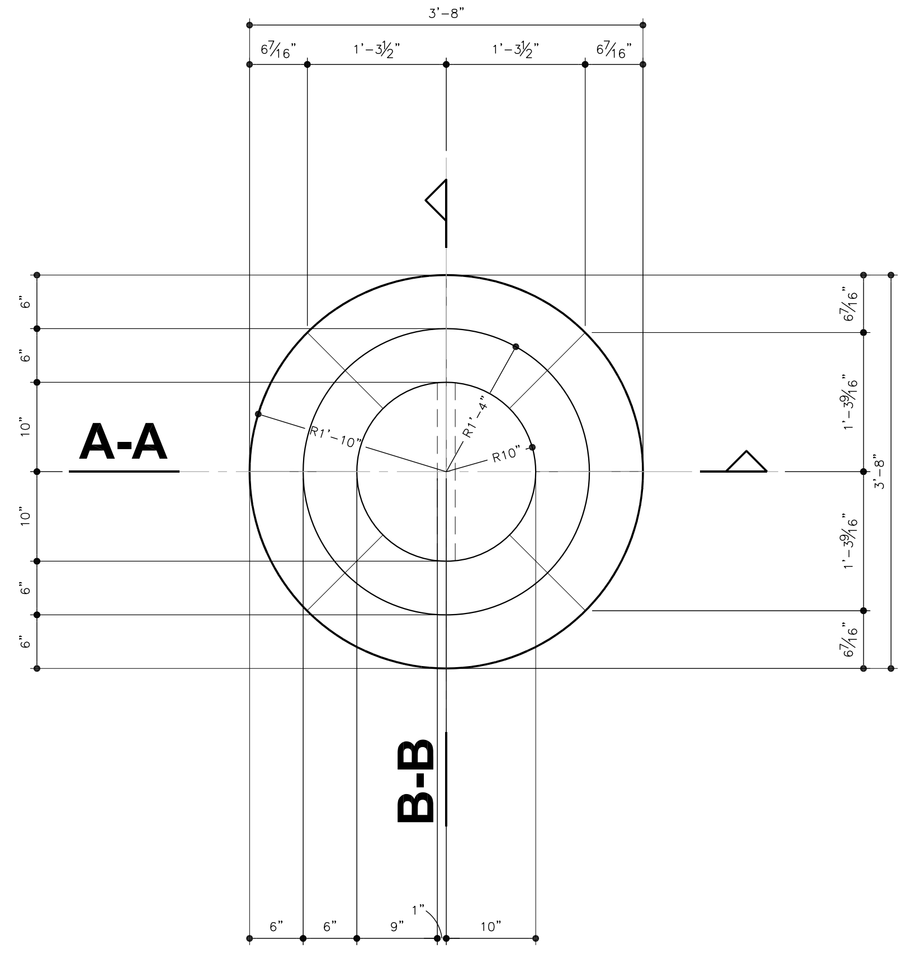
#	COMPONENT NAME
1	BASE PLATE
2	INTERMEDIATE BLOCK
3	UNIT BLOCK



1 BASE PLATE

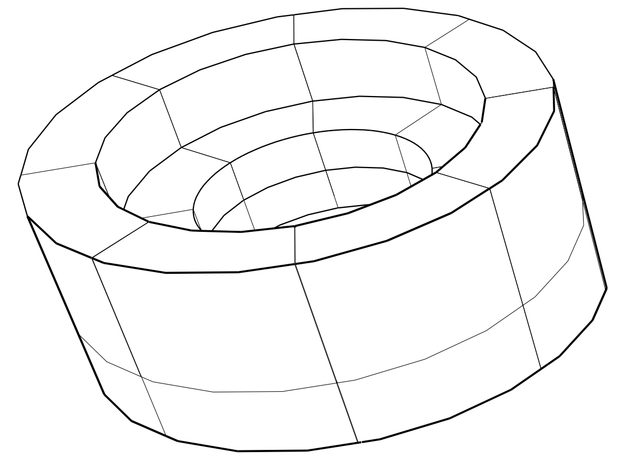


2 RISER BLOCK

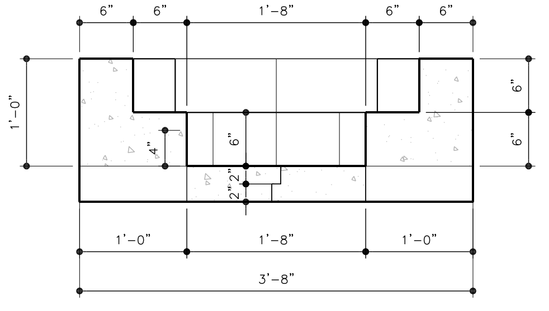


PLAN

SCALE: 1" = 1'-0"

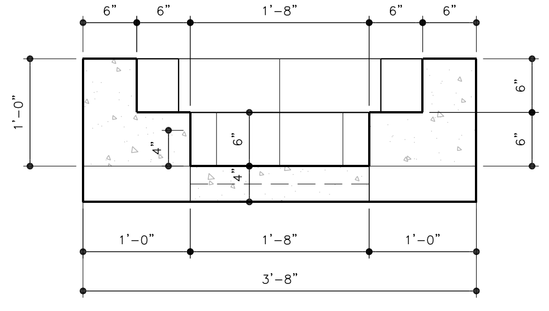


ISOMETRIC



SECTIION A-A

SCALE: 1" = 1'-0"



SECTION B-B

SCALE: 1" = 1'-0"

RELEASE DATE 01/19/12

SCALE 1" = 1'-0"

SHEET

FRP-RND

PELHAM RENAMING EFFORT

FORT MCCLELLAN, ALABAMA

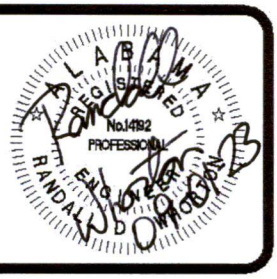
WHORTON ENGINEERING, INC.

CONSULTING ENGINEERS

RANDALL WHORTON, P.E., C.E.M.

PH: (256)820-9897
FAX: (256)820-9896

25 SUMMERALL GATE ROAD
ANNISTON, ALABAMA 36205



MECHANICAL SPECIFICATIONS FOR PELHAM RENAMING EFFORT - FORT McCLELLAN, ALABAMA

21 05 17	Sleeves and Sleeve Seals for Fire-Suppression Piping
21 05 18	Escutcheons for Fire-Suppression Piping
21 05 23	General-Duty Valves for Water-Based Fire-Suppression Piping
21 05 29	Hangers and Supports for Fire-Suppression Piping and Equipment
21 05 53	Identification for Fire-Suppression Piping and Equipment
21 13 13	Wet-Pipe Sprinkler Systems
22 05 10	Basic Mechanical Requirements
22 05 11	Basic Mechanical Materials and Methods
22 05 13	Common Motor Requirements for Plumbing Equipment
22 05 17	Sleeves and Sleeve Seals for Plumbing Piping
22 05 18	Escutcheons for Plumbing Piping
22 05 19	Meters and Gages for Plumbing Piping
22 05 23.12	Ball Valves for Plumbing Piping
22 05 23.14	Check Valves for Plumbing Piping
22 05 23.15	Gate Valves for Plumbing Piping
22 05 29	Hangers and Supports for Plumbing Piping and Equipment
22 05 53	Identification for Plumbing Piping and Equipment
22 07 19	Plumbing Piping Insulation
22 11 16	Domestic Water Piping
22 11 19	Domestic Water Piping Specialties
22 11 23	Facility Natural-Gas Piping
22 13 16	Sanitary Waste and Vent Piping
22 13 19	Sanitary Waste Piping Specialties
22 13 19.13	Sanitary Drains
22 34 00	Fuel-Fired, Domestic-Water Heaters
23 05 10	Basic Mechanical Requirements
23 05 11	Basic Mechanical Materials and Methods
23 05 13	Common Motor Requirements for HVAC Equipment
23 05 17	Sleeves and Sleeve Seals for HVAC Piping
23 05 18	Escutcheons for HVAC Piping
23 05 19	Meters and Gages for HVAC Piping
23 05 29	Hangers and Supports for HVAC Piping and Equipment
23 05 53	Identification for HVAC Piping and Equipment
23 05 93	Testing, Adjusting, and Balancing
23 07 13	Duct Insulation
23 07 19	HVAC Piping Insulation
23 23 00	Refrigerant Piping
23 31 13	Metal Ducts
23 33 00	Duct Accessories
23 37 13	Air Outlets and Inlets

SECTION 21 05 17 - SLEEVES AND SLEEVE SEALS FOR FIRE-SUPPRESSION PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Sleeves.
2. Stack-sleeve fittings.
3. Sleeve-seal systems.
4. Sleeve-seal fittings.
5. Grout.
6. Silicone sealants.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Cast-Iron Pipe Sleeves: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop.

B. Steel Pipe Sleeves: ASTM A53/A53M, Type E, Grade B, Schedule 40, anticorrosion coated or galvanized, with plain ends and integral welded waterstop collar.

C. Galvanized-Steel Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

D. PVC Pipe Sleeves: ASTM D1785, Schedule 40.

E. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

F. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

2.2 STACK-SLEEVE FITTINGS

A. Description: Manufactured, Dura-coated or Duco-coated galvanized cast-iron sleeve with integral clamping flange for use in waterproof floors and roofs. Include clamping ring, bolts, and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with setscrews.

2.3 SLEEVE-SEAL SYSTEMS

A. Description:

1. Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
2. Designed to form a hydrostatic seal of 20 psig minimum.
3. Sealing Elements: Nitrile (Buna N) interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size.
4. Pressure Plates: Carbon steel or Stainless steel.
5. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, ASTM B633 or Stainless steel of length required to secure pressure plates to sealing elements.

2.4 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall.

B. Plastic or rubber waterstop collar with center opening to match piping OD.

2.5 GROUT

A. Description: Nonshrink, for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.6 SILICONE SEALANTS

A. Silicone, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant, ASTM C920, Type S, Grade NS, Class 25, Use NT.

B. Silicone, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade P, Class 25, Uses T and NT. Grade P Pourable (self-leveling) formulation is for opening in floors and other horizontal surfaces that are not fire rated.

C. Silicone Foam: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.

2. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.

3. Using grout or silicone sealant, seal space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.

2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.

3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint.

E. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping and fill materials.

3.2 STACK-SLEEVE-FITTING INSTALLATION

A. Install stack-sleeve fittings in new slabs as slabs are constructed.

1. Install fittings that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.

2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section 07 62 00 "Sheet Metal Flashing and Trim."
3. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
5. Use silicone sealant to seal around the outside of stack-sleeve fittings.

B. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of floors at pipe penetrations. Seal pipe penetrations with fire- or smoke-stop materials. Comply with requirements for firestopping.

3.3 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.4 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Use grout or silicone sealant, to seal the space around outside of sleeve-seal fittings.

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Leak Test: After allowing for a full cure, test sleeves and sleeve seals for leaks. Repair leaks and retest until no leaks exist.

B. Sleeves and sleeve seals will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.6 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls above Grade:
   a. Piping Smaller Than NPS 6: Cast-iron pipe sleeves, Steel pipe sleeves or Sleeve-seal fittings.
   b. Piping NPS 6 and Larger: Cast-iron pipe sleeves, Steel pipe sleeves or Sleeve-seal fittings.
2. Exterior Concrete Walls below Grade:
   a. Piping Smaller Than NPS 6: Cast-iron pipe sleeves with sleeve-seal system, Steel pipe sleeves with sleeve-seal system, or Sleeve-seal fittings.
      1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
   b. Piping NPS 6 and Larger: Cast-iron pipe sleeves with sleeve-seal system or Steel pipe sleeves with sleeve-seal system.
      1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
3. Concrete Slabs-on-Grade:
   a. Piping Smaller Than NPS 6: Cast-iron pipe sleeves with sleeve-seal system, Steel pipe sleeves with sleeve-seal system, or Sleeve-seal fittings.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

b. Piping NPS 6 and Larger: Cast-iron pipe sleeves with sleeve-seal system, Steel pipe sleeves with sleeve-seal system, or Sleeve-seal fittings.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

4. Concrete Slabs above Grade:

a. Piping Smaller Than NPS 6: Steel pipe sleeves, PVC pipe sleeves, Stack-sleeve fittings, Sleeve-seal fittings, Molded-PE or -PP sleeves, or Molded-PVC sleeves.

b. Piping NPS 6 and Larger: Steel pipe sleeves, PVC pipe sleeves, or Stack-sleeve fittings.

5. Interior Partitions:

a. Piping Smaller Than NPS 6: Steel pipe sleeves.

b. Piping NPS 6 and Larger: Galvanized-steel sheet sleeves.

END OF SECTION

SECTION 21 05 18 - ESCUTCHEONS FOR FIRE-SUPPRESSION PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Escutcheons.
2. Floor plates.

1.3 DEFINITIONS

A. Existing Piping to Remain: Existing piping that is not to be removed and that is not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

A. One-Piece, Steel Type: With polished, chrome-plated finish and setscrew fastener.

B. One-Piece, Stainless-Steel Type: With polished stainless-steel finish.

C. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.

D. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished, chrome-plated finish and spring-clip fasteners.

E. One-Piece, Stamped-Steel Type: With polished, chrome-plated finish and spring-clip fasteners.

F. Split-Plate, Stamped-Steel Type: With polished, chrome-plated finish; concealed hinge; and spring-clip fasteners.

2.2 FLOOR PLATES

A. Split Floor Plates: Steel with concealed hinge.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. Escutcheons for New Piping and Relocated Existing Piping:
    a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep pattern.
    b. Chrome-Plated Piping: One-piece cast brass with polished, chrome-plated finish.
    c. Insulated Piping: One-piece cast brass with polished, chrome-plated finish.
    d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece cast brass with polished, chrome-plated finish.
    e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece cast brass with polished, chrome-plated finish.
    f. Bare Piping in Unfinished Service Spaces: One-piece cast brass with polished, chrome-plated finish.
    g. Bare Piping in Equipment Rooms: One-piece cast brass with polished, chrome-plated finish.
2. Escutcheons for Existing Piping to Remain:

a. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.

b. Bare Piping in Unfinished Service Spaces: Split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. New Piping and Relocated Existing Piping: One-piece, floor plate.

2. Existing Piping: Split floor plate.

3.2 FIELD QUALITY CONTROL

A. Using new materials, replace broken and damaged escutcheons and floor plates.

END OF SECTION

SECTION 21 05 23 - GENERAL-DUTY VALVES FOR WATER-BASED FIRE-SUPPRESSION PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Two-piece ball valves with indicators.
2. Bronze butterfly valves with indicators.
3. Iron butterfly valves with indicators.
4. Check valves.
5. Bronze OS&Y gate valves.
6. Iron OS&Y gate valves.
7. NRS gate valves.
8. Indicator posts.
9. Trim and drain valves.

1.3 DEFINITIONS

A. NRS: Nonrising stem.

B. OS&Y: Outside screw and yoke.

C. SBR: Styrene-butadiene rubber.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, and weld ends.
3. Set valves open to minimize exposure of functional surfaces.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher-than-ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use operating handles or stems as lifting or rigging points.

D. Protect flanges and specialties from moisture and dirt.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain each type of valve from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. UL Listed: Valves shall be listed in UL's "Online Certifications Directory" under the headings listed below and shall bear UL mark:

1. Fire Main Equipment: HAMV - Main Level
   a. Indicator Posts, Gate Valve: HCBZ - Level 1
   b. Ball Valves, System Control: HLUG - Level 3
   c. Butterfly Valves: HLXS - Level 3

d. Check Valves: HMER - Level 3

e. Gate Valves: HMRZ - Level 3

2. Sprinkler System & Water Spray System Devices: VDGT - Main Level

a. Valves, Trim and Drain: VQGU - Level 1

B. FM Global Approved: Valves shall be listed in its "Approval Guide," under the headings listed below:

1. Automated Sprinkler Systems:

a. Indicator posts.

b. Valves.

1) Gate valves.

2) Check valves

3) Miscellaneous valves.

C. ASME Compliance:

1. ASME B1.20.1 for threads for threaded-end valves.

2. ASME B16.1 for flanges on iron valves.

3. ASME B31.9 for building services piping valves.

D. AWWA Compliance: Comply with AWWA C606 for grooved-end connections.

E. NFPA Compliance for valves:

1. Comply with NFPA 13D, NFPA 14, NFPA 20, and NFPA 24.

F. Valve Pressure Ratings: Not less than the minimum pressure rating indicated or higher, as required by system pressures.

G. Valve Sizes: Same as upstream piping unless otherwise indicated.

H. Valve Actuator Types:

1. Worm-gear actuator with handwheel for quarter-turn valves, except for trim and drain valves.

2. Handwheel: For other than quarter-turn trim and drain valves.

3. Handlever: For quarter-turn trim and drain valves NPS 2 and smaller.

2.3 TWO-PIECE BALL VALVES WITH INDICATORS

A. Description:

1. UL 1091, except with ball instead of disc and FM Global approved for indicating valves (butterfly or ball type), Class Number 1112.

2. Minimum Pressure Rating: 175 psig.

3. Body Design: Two piece.

4. Body Material: Forged brass or bronze.

5. Port Size: Full or standard.

6. Seats: PTFE.

7. Stem: Bronze or stainless steel.

8. Ball: Chrome-plated brass.

9. Actuator: Worm gear

10. Supervisory Switch: Internal or external.

11. End Connections for Valves NPS 1 through NPS 2: Threaded ends.

12. End Connections for Valves NPS 2-1/2: Grooved ends.

2.4 BRONZE BUTTERFLY VALVES WITH INDICATORS

A. Description:

1. Standard: UL 1091 and FM Global standard for indicating valves, (butterfly or ball type), Class Number 1112.

2. Minimum: Pressure rating: 175 psig.
3. Body Material: Bronze.
4. Seat Material: EPDM.
5. Stem Material: Bronze or stainless steel.
6. Disc: Stainless steel.
7. Actuator: Worm gear.
8. Supervisory Switch: Internal or external.
9. Ends Connections for Valves NPS 1 through NPS 2: Threaded ends.
10. Ends Connections for Valves NPS 2-1/2: Grooved ends.

2.5 IRON BUTTERFLY VALVES WITH INDICATORS

A. Description:

1. Standard: UL 1091 and FM Global standard for indicating valves, (butterfly or ball type), Class Number 112.
2. Minimum Pressure Rating: 175 psig.
3. Body Material: Cast or ductile iron with nylon, EPDM, epoxy, or polyamide coating.
4. Seat Material: EPDM.
5. Stem: Stainless steel.
6. Disc: Ductile iron, nickel plated and EPDM or SBR coated.
7. Actuator: Worm gear.
8. Supervisory Switch: Internal or external.
9. Body Design: Lug or wafer Grooved-end connections.

2.6 CHECK VALVES

A. Description:

1. Standard: UL 312 and FM Global standard for swing check valves, Class Number 1210.
2. Minimum Pressure Rating: 175 psig.
3. Type: Single swing check.
4. Body Material: Cast iron, ductile iron, or bronze.
5. Clapper: Bronze, ductile iron, or stainless steel with elastomeric seal.
6. Clapper Seat: Brass, bronze, or stainless steel.
7. Hinge Shaft: Bronze or stainless steel.
8. Hinge Spring: Stainless steel.
9. End Connections: Flanged, grooved, or threaded.

2.7 BRONZE OS&Y GATE VALVES

A. Description:

1. Standard: UL 262 and FM Global standard for fire-service water control valves (OS&Y- and NRS-type gate valves).
2. Minimum Pressure Rating: 175 psig.
3. Body and Bonnet Material: Bronze or brass.
4. Wedge: One-piece bronze or brass.
5. Wedge Seat: Bronze.
6. Stem: Bronze or brass.
7. Packing: Non-asbestos PTFE.
8. Supervisory Switch: External.
9. End Connections: Threaded.

2.8 IRON OS&Y GATE VALVES

A. Description:

1. Standard: UL 262 and FM Global standard for fire-service water control valves (OS&Y- and NRS-type gate valves).
2. Minimum Pressure Rating: 175 psig.
3. Body and Bonnet Material: Cast or ductile iron.
4. Wedge: Cast or ductile iron, or bronze with elastomeric coating.
5. Wedge Seat: Cast or ductile iron, or bronze with elastomeric coating.
6. Stem: Brass or bronze.
7. Packing: Non-asbestos PTFE.
8. Supervisory Switch: External.
9. End Connections: Flanged or Grooved.

2.9 NRS GATE VALVES

A. Description:

1. Standard: UL 262 and FM Global standard for fire-service water control valves (OS&Y- and NRS-type gate valves).
2. Minimum Pressure Rating: 175 psig.
3. Body and Bonnet Material: Cast or ductile iron.
4. Wedge: Cast or ductile iron with elastomeric coating.
5. Wedge Seat: Cast or ductile iron, or bronze with elastomeric coating.
6. Stem: Brass or bronze.
7. Packing: Non-asbestos PTFE.
8. Supervisory Switch: External.
9. End Connections: Flanged or Grooved.

2.10 INDICATOR POSTS

A. Description:

1. Standard: UL 789 and FM Global standard for indicator posts.
2. Type: Upright.
3. Base Barrel Material: Cast or ductile iron.
4. Extension Barrel: Cast or ductile iron.
5. Cap: Cast or ductile iron.
6. Operation: Wrench.

2.11 TRIM AND DRAIN VALVES

A. Ball Valves:

1. Description:
   a. Pressure Rating: 175 psig.
   b. Body Design: Two piece.
   c. Body Material: Forged brass or bronze.
   d. Port size: Full or standard.
   e. Seats: PTFE.
   f. Stem: Bronze or stainless steel.
   g. Ball: Chrome-plated brass.
   h. Actuator: Handlever.
   i. End Connections for Valves NPS 1 through NPS 2-1/2: Threaded ends.
   j. End Connections for Valves NPS 1-1/4 and NPS 2-1/2: Grooved ends.

B. Angle Valves:
   1. Description:
      a. Pressure Rating: 175 psig.
      b. Body Material: Brass or bronze.
      c. Ends: Threaded.
      d. Stem: Bronze.
      e. Disc: Bronze.
      f. Packing: Asbestos free.
      g. Handwheel: Malleable iron, bronze, or aluminum.

C. Globe Valves:
   1. Description:
      a. Pressure Rating: 175 psig.
      b. Body Material: Bronze with integral seat and screw-in bonnet.
      c. Ends: Threaded.
      d. Stem: Bronze.
      e. Disc Holder and Nut: Bronze.
      f. Disc Seat: Nitrile.
      g. Packing: Asbestos free.
      h. Handwheel: Malleable iron, bronze, or aluminum.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 INSTALLATION, GENERAL

A. Comply with requirements in the following Sections for specific valve-installation requirements and applications:
   1. Section 21 13 13 "Wet-Pipe Sprinkler Systems" for application of valves in wet-pipe, fire-suppression sprinkler systems.

B. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply, except from fire-department connections. Install permanent identification signs, indicating portion of system controlled by each valve.

C. Install double-check valve assembly in each fire-protection water-supply connection.

D. Install valves having threaded connections with unions at each piece of equipment arranged to allow easy access, service, maintenance, and equipment removal without system shutdown. Provide separate support where necessary.

E. Install valves in horizontal piping with stem at or above the pipe center.

F. Install valves in position to allow full stem movement.

G. Install valve tags. Comply with requirements in Section 21 05 53 "Identification for Fire-Suppression Piping and Equipment" for valve tags and schedules and signs on surfaces

concealing valves; and the NFPA standard applying to the piping system in which valves are installed. Install permanent identification signs indicating the portion of system controlled by each valve.

END OF SECTION

SECTION 21 05 29 - HANGERS AND SUPPORTS FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal hanger-shield inserts.
5. Fastener systems.
6. Equipment supports.

B. Related Requirements:

1. Section 05 50 00 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Section 21 05 16 "Expansion Fittings and Loops for Fire-Suppression Piping" for pipe guides and anchors.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:

1. Trapeze pipe hangers.
2. Metal framing systems.
3. Equipment supports.

C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of trapeze hangers.
2. Include design calculations for designing trapeze hangers.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.5 QUALITY ASSURANCE

A. Structural-Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M.

B. Pipe Welding Qualifications: Qualify procedures and operators according to 2015 ASME Boiler and Pressure Vessel Code, Section IX.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. NFPA Compliance: Comply with NFPA 13D.

B. UL Compliance: Comply with UL 203.

2.2 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: Factory-fabricated components, NFPA approved, UL listed, or FM approved for fire-suppression piping support.

2. Galvanized Metallic Coatings: Pregalvanized or hot-dip galvanized.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Copper Pipe and Tube Hangers:
1. Description: Copper-coated-steel, factory-fabricated components, NFPA approved, UL listed, or FM approved for fire-suppression piping support.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly, made from structural-carbon-steel shapes, with NFPA-approved, UL-listed, or FM-approved carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.4 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:
1. Description: Shop- or field-fabricated pipe-support assembly, made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
2. Standard: Comply with MFMA-4, factory-fabricated components for field assembly.
3. Channels: Continuous slotted carbon-steel channel with inturned lips.
4. Channel Width: Selected for applicable load criteria.
5. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
7. Metallic Coating: No coating.

B. Non-MFMA Manufacturer Metal Framing Systems:
1. Description: Shop- or field-fabricated pipe-support assembly, made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
2. Standard: Comply with MFMA-4, factory-fabricated components for field assembly.
3. Channels: Continuous slotted carbon-steel channel with inturned lips.
4. Channel Width: Select for applicable load criteria.
5. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
7. Metallic Coating: No coating.

2.5 THERMAL HANGER-SHIELD INSERTS

A. Insulation-Insert Material: Water-repellent-treated, ASTM C533, Type I calcium silicate with 100-psi minimum compressive strength.

B. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

C. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

D. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.6 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: NFPA-approved, UL-listed, or FM-approved threaded-steel stud, for use in hardened portland cement concrete, with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: NFPA-approved, UL-listed, or FM-approved, insert-wedge-type anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
1. Indoor Applications: Zinc-coated or Stainless steel.
2. Outdoor Applications: Stainless steel.

2.7 EQUIPMENT SUPPORTS

A. Description: NFPA-approved, UL-listed, or FM-approved, welded, shop- or field-fabricated equipment support, made from structural-carbon-steel shapes.

2.8 MATERIALS

A. Aluminum: ASTM B221.

B. Carbon Steel: ASTM A1011/A1011M.

C. Structural Steel: ASTM A36/A36M, carbon-steel plates, shapes, and bars; black and galvanized.

D. Stainless Steel: ASTM A240/A240M.

E. Grout: ASTM C1107/C1107M, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout, suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.

2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with requirements in Section 07 84 13 "Penetration Firestopping" for firestopping materials and installation, for penetrations through fire-rated walls, ceilings, and assemblies.

B. Strength of Support Assemblies: Where not indicated, select sizes of components, so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

3.2 INSTALLATION OF HANGERS AND SUPPORTS

A. Metal Pipe-Hanger Installation: Comply with installation requirements of approvals and listings. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size, or install intermediate supports for smaller-diameter pipes as specified for individual pipe hangers.

2. Field fabricate from ASTM A36/A36M carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal strut systems.

D. Thermal Hanger-Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete, after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual. Install in accordance with approvals and listings.

2. Install mechanical-expansion anchors in concrete, after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions. Install in accordance with approvals and listings.

F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

I. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms, and install reinforcing bars through openings at top of inserts.

K. Load Distribution: Install hangers and supports, so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

M. Insulated Piping:

1. Attach clamps and spacers to piping.
    a. Piping Operating Above Ambient Air Temperature: Clamp may project through insulation.
    b. Piping Operating Below Ambient Air Temperature: Use thermal hanger-shield insert with clamp sized to match OD of insert.
    c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
2. Install MSS SP-58, Type 39 protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
    a. MSS SP-58, Type 39 Option: Thermal hanger-shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
3. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
    a. MSS SP-58, Type 40 Option: Thermal hanger-shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
4. Shield Dimensions for Pipe: Not less than the following:
    a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
    b. NPS 4: 12 inches long and 0.06 inch thick.
    c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
    d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
    e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal Hanger Shields: Install with insulation of same thickness as piping insulation.

3.3 INSTALLATION OF EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment, and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections, so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.6 PAINTING

A. Touchup:

1. Clean field welds and abraded, shop-painted areas. Paint exposed areas immediately after erecting hangers and supports. Use same materials as those used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
   a. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas, and apply galvanizing-repair paint to comply with ASTM A780/A780M.

3.7 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with NFPA requirements for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finishes.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports, metal trapeze pipe hangers and metal framing systems and attachments for general service applications.

F. Use stainless-steel pipe hangers and attachments for hostile environment applications.

G. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.

H. Use thermal hanger-shield inserts for insulated piping and tubing.

I. Horizontal-Piping Hangers and Supports: Comply with NFPA requirements. Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Steel Pipe Clamps (MSS Type 4): For suspension of NPS 1/2 to NPS 24 if little or no insulation is required.
3. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
4. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
5. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
6. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
7. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.

8. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
9. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.

J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

K. Hanger-Rod Attachments: Comply with NFPA requirements.

L. Building Attachments: Comply with NFPA requirements. Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable-Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. C-Clamps (MSS Type 23): For structural shapes.
3. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.

M. Saddles and Shields: Comply with NFPA requirements. Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal Hanger-Shield Inserts: For supporting insulated pipe.

N. Comply with NFPA requirements for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

O. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

P. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION

SECTION 21 05 53- IDENTIFICATION FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Stencils.
5. Valve tags.
6. Warning tags.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment-Label Schedule: Include a listing of all equipment to be labeled and the proposed content for each label.

D. Valve Schedules: Valve numbering scheme.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: Brass, 0.032 inch, stainless steel, 0.025 inch, aluminum, 0.032 inch or anodized aluminum, 0.032 inch thick, with predrilled holes for attachment hardware.
2. Letter Color: Red.
3. Background Color: White.
4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
5. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
6. Fasteners: Stainless-steel rivets or self-tapping screws.
7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, with predrilled holes for attachment hardware.
2. Letter Color: Red.
3. Background Color: White.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for

greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

7. Fasteners: Stainless-steel rivets or self-tapping screws.

8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

D. Equipment-Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, with predrilled holes for attachment hardware.

B. Letter Color: Red.

C. Background Color: White.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service and showing flow direction according to ASME A13.1.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe-Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.

2. Lettering Size: Size letters according to ASME A13.1 for piping.

E. Pipe-Label Colors:

1. Background Color: Safety Red.

2. Letter Color: White.

2.4 STENCILS

A. Stencils for Piping:

1. Lettering Size: Size letters according to ASME A13.1 for piping.

2. Stencil Material: Fiberboard or metal.

3. Stencil Paint: Safety Red, exterior, gloss, alkyd enamel. Paint may be in pressurized spray-can form.

4. Identification Paint: White, exterior, alkyd enamel. Paint may be in pressurized spray-can form.

2.5 VALVE TAGS

A. Description: Stamped or engraved with 1/4-inch letters for piping-system abbreviation and 1/2-inch numbers.

1. Tag Material: Brass, 0.032 inch or anodized aluminum, 0.032 inch thick, with predrilled holes for attachment hardware.
2. Fasteners: Brass wire-link chain or S-hook.
3. Valve-Tag Color: Safety Red.
4. Letter Color: White.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of incompatible primers, paints, and encapsulants, as well as dirt, oil, grease, release agents, and other substances that could impair bond of identification devices.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be installed.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

3.3 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.4 PIPE LABEL INSTALLATION

A. Stenciled Pipe-Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, with painted, color-coded bands or rectangles on each piping system.

1. Identification Paint: Use for contrasting background.
2. Stencil Paint: Use for pipe marking.

B. Pipe-Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection excluding short takeoffs. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit a view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

C. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes including pipes where flow is allowed in both directions.

3.5 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in fire-suppression piping systems. List tagged valves in a valve-tag schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and with captions similar to those indicated in "Valve-Tag Size and Shape" Subparagraph below:

1. Valve-Tag Size and Shape:

a. Wet-Pipe Sprinkler System: 1-1/2 inches.

END OF SECTION

SECTION 21 13 13 - WET-PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Pipes, fittings, and specialties.
2. Cover system for sprinkler piping.
3. Specialty valves.
4. Sprinklers.
5. Alarm devices.
6. Manual control stations.
7. Control panels.
8. Pressure gauges.

B. Related Requirements:

1. Section 21 11 19 "Fire Department Connections" for exposed-, flush-, and yard-type fire department connections.
2. Section 23 05 23 "General-Duty Valves for Water-Based Fire-Suppression Piping" for ball, butterfly, check, gate, post-indicator, and trim and drain valves.

1.3 DEFINITIONS

A. High-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure higher than standard 175 psig, but not higher than 250 psig.

B. Standard-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure of 175-psig maximum.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Sustainable Design Submittals:

1. Product Data: For adhesives, indicating VOC content.
2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.

C. Shop Drawings: For wet-pipe sprinkler systems.

1. Include plans, elevations, sections, and attachment details.
2. Include diagrams for power, signal, and control wiring.

D. Delegated-Design Submittal: For wet-pipe sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Sprinkler systems, or BIM model, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved.

B. Qualification Data: For qualified Installer and professional engineer.

C. Design Data:

1. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13D, that have been approved by authorities having jurisdiction, including hydraulic calculations.

D. Welding certificates.

E. Field Test Reports:

1. Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13D. Include "Contractor's Material and Test Certificate for Aboveground Piping."

2. Fire-hydrant flow test report.

F. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wet-pipe sprinkler systems and specialties to include in emergency, operation, and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13D and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler used on Project.

1.8 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.

a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.

B. Welding Qualifications: Qualify procedures and operators according to 2010 ASME Boiler and Pressure Vessel Code.

1.9 FIELD CONDITIONS

A. Interruption of Existing Sprinkler Service: Do not interrupt sprinkler service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary sprinkler service according to requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of sprinkler service.

2. Do not proceed with interruption of sprinkler service without Owner's written permission.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with NFPA 13D.

C. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.

D. High-Pressure Piping System Component: Listed for 250-psig minimum working pressure.

E. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design wet-pipe sprinkler systems.

1. Sprinkler system design shall be approved by authorities having jurisdiction.

a. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.

b. Sprinkler Occupancy Hazard Classifications: Residential

2. Minimum Density for Automatic-Sprinkler Piping Design:

a. Residential (Dwelling) Occupancy: 0.05 gpm over 400-sq. ft. area.

3. Maximum protection area per sprinkler according to UL listing.

4. Maximum Protection Area per Sprinkler:

a. Residential Areas: 400 sq. ft..

2.2 STEEL PIPE AND FITTINGS

A. Standard-Weight, Galvanized- and Black-Steel Pipe: ASTM A53/A53M,,. Pipe ends may be factory or field formed to match joining method.

B. Schedule 30, Galvanized- and Black-Steel Pipe: ASTM A135/A135M; ASTM A795/A795M, Type E; or ASME B36.10M wrought steel, with wall thickness not less than Schedule 30 and not more than Schedule 40. Pipe ends may be factory or field formed to match joining method.

C. Thinwall Galvanized- and Black-Steel Pipe: ASTM A135/A135M or ASTM A795/A795M, threadable, with wall thickness less than Schedule 30 and equal to or greater than Schedule 10. Pipe ends may be factory or field formed to match joining method.

D. Galvanized- and Black-Steel Pipe Nipples: ASTM A733, made of ASTM A53/A53M, standard-weight, seamless steel pipe with threaded ends.

E. Galvanized- and Uncoated-Steel Couplings: ASTM A865/A865M, threaded.

F. Galvanized and Uncoated, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.

G. Malleable- or Ductile-Iron Unions: UL 860.

H. Cast-Iron Flanges: ASME 16.1, Class 125.

I. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.

1. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick or EPDM rubber gasket.

a. Class 125 and Class 250, Cast-Iron, Flat-Face Flanges: Full-face gaskets.

b. Class 150 and Class 300, Ductile-Iron or -Steel, Raised-Face Flanges: Ring-type gaskets.

2. Metal, Pipe-Flange Bolts and Nuts: Carbon steel unless otherwise indicated.

J. Steel Welding Fittings: ASTM A234/A234M and ASME B16.9.

1. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

K. Grooved-Joint, Steel-Pipe Appurtenances:

1. Pressure Rating: 175-psig minimum.

2. Galvanized Grooved-End Fittings for Steel Piping: ASTM A47/A47M, malleable-iron casting or ASTM A536, ductile-iron casting, with dimensions matching steel pipe.

3. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213 rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

L. Steel Pressure-Seal Fittings: UL 213, FM Global-approved, 175-psig pressure rating with steel housing, rubber O-rings, and pipe stop; for use with fitting manufacturers' pressure-seal tools.

2.3 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tube: ASTM B88, Type K (ASTM B88M, Type A) and ASTM B88, Type M.

B. Cast-Copper, Solder-Joint Fittings: ASME B16.18 pressure fittings.

C. Wrought-Copper, Solder-Joint Fittings: ASME B16.22 pressure fittings.

D. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.

E. Cast Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.

F. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

G. Copper-Tube, Mechanically Formed Tee Fitting: For forming T-branch on copper water tube.

1. Description: Tee formed in copper tube according to ASTM F2014.

H. Grooved, Mechanical-Joint, Copper-Tube Appurtenances:

1. Standard: UL 213.
2. Grooved-End Copper Fittings: ASTM B75 copper tube or ASTM B584 bronze castings.
3. Grooved-End-Tube Couplings: To fit copper tube dimensions; rigid pattern unless otherwise indicated; gasketed fitting EPDM-rubber gasket rated for minimum 180 deg F for use with ferrous housing and steel bolts and nuts; 300 psig minimum CWP pressure rating.

I. Copper-Tube, Pressure-Seal-Joint Fittings:

1. Fittings: Cast-brass, cast-bronze, or wrought-copper with EPDM O-ring seal in each end.
2. Minimum 200-psig working-pressure rating at 250 deg F.

2.4 COVER SYSTEM FOR SPRINKLER PIPING

A. Description: System of support brackets and covers made to protect sprinkler piping.

B. Brackets: Glass-reinforced nylon.

C. Covers: Extruded-PVC sections of length, shape, and size required for size and routing of CPVC piping.

2.5 SPECIALTY VALVES

A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."

B. Pressure Rating:

1. Standard-Pressure Piping Specialty Valves: 175-psig minimum.
2. High-Pressure Piping Specialty Valves: 250-psig minimum.

C. Body Material: Cast or ductile iron.

D. Size: Same as connected piping.

E. End Connections: Flanged or grooved.

F. Alarm Valves:

1. Standard: UL 193.
2. Design: For horizontal or vertical installation.
3. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gauges, retarding chamber, and fill-line attachment with strainer.
4. Drip cup assembly pipe drain without valves and separate from main drain piping with check valve to main drain piping.
5. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

G. Deluge Valves:

1. Standard: UL 260.
2. Design: Hydraulically operated, differential-pressure type.
3. Include trim sets for alarm-test bypass, drain, electrical water-flow alarm switch, pressure gauges, drip cup assembly piped without valves and separate from main drain line, and fill-line attachment with strainer.
4. Wet, Pilot-Line Trim Set: Include gauge to read diaphragm-chamber pressure and manual control station for manual operation of deluge valve, and connection for actuation device.

H. Automatic (Ball Drip) Drain Valves:

1. Standard: UL 1726.

2. Pressure Rating: 175-psig minimum.
3. Type: Automatic draining, ball check.
4. Size: NPS 3/4.
5. End Connections: Threaded.

2.6 AIR VENT

A. Manual Air Vent/Valve:
1. Description: Ball valve that requires human intervention to vent air.
2. Body: Forged brass.
3. Ends: Threaded.
4. Minimize Size: 1/2 inch.
5. Minimum Water Working Pressure Rating: 300 psig.

B. Automatic Air Vent:
1. Description: Automatic air vent that automatically vents trapped air without human intervention.
2. Standard: UL listed or FM Global approved for use in wet-pipe fire sprinkler systems.
3. Vents oxygen continuously from system.
4. Float valve to prevent water discharge.
5. Minimum Water Working Pressure Rating: 175 psig.

C. Automatic Air Vent Assembly:
1. Description: Automatic dual air vent assembly that automatically vents trapped air without human intervention, including Y-strainer and ball valve in a pre-piped assembly.
2. Standard: UL listed or FM Global approved for use in wet-pipe fire sprinkler system.
3. Vents oxygen continuously from system.
4. Float valve to prevent water discharge.
5. Minimum Water Working Pressure Rating: 175 psig.

2.7 SPRINKLER PIPING SPECIALTIES

A. Branch Outlet Fittings:
1. Standard: UL 213.
2. Pressure Rating: 175-psig minimum.
3. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
4. Type: Mechanical-tee and -cross fittings.
5. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
6. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
7. Branch Outlets: Grooved, plain-end pipe, or threaded.

B. Flow Detection and Test Assemblies:
1. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
2. Pressure Rating: 175-psig minimum.
3. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
4. Size: Same as connected piping.
5. Inlet and Outlet: Threaded or grooved.

C. Branch Line Testers:
1. Standard: UL 199.
2. Pressure Rating: 175 psig.

3. Body Material: Brass.
4. Size: Same as connected piping.
5. Inlet: Threaded.
6. Drain Outlet: Threaded and capped.
7. Branch Outlet: Threaded, for sprinkler.

D. Sprinkler Inspector's Test Fittings:
1. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
2. Pressure Rating: 175-psig minimum.
3. Body Material: Cast- or ductile-iron housing with sight glass.
4. Size: Same as connected piping.
5. Inlet and Outlet: Threaded.

E. Adjustable Drop Nipples:
1. Standard: UL 1474.
2. Pressure Rating: 250-psig minimum.
3. Body Material: Steel pipe with EPDM-rubber O-ring seals.
4. Size: Same as connected piping.
5. Length: Adjustable.
6. Inlet and Outlet: Threaded.

F. Flexible Sprinkler Hose Fittings:
1. Standard: UL 1474.
2. Type: Flexible hose for connection to sprinkler, and with bracket for connection to ceiling grid.
3. Pressure Rating: 175-psig minimum.
4. Size: Same as connected piping, for sprinkler.

2.8 SPRINKLERS

A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."

B. Pressure Rating for Residential Sprinklers: 175-psig maximum.

C. Pressure Rating for Automatic Sprinklers: 175-psig minimum.

D. Pressure Rating for High-Pressure Automatic Sprinklers: 250-psig minimum.

E. Automatic Sprinklers with Heat-Responsive Element:
1. Early-Suppression, Fast-Response Applications: UL 1767.
2. Nonresidential Applications: UL 199.
3. Residential Applications: UL 1626.
4. Characteristics: Nominal 1/2-inch orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.

F. Open Sprinklers with Heat-Responsive Element Removed: UL 199.
1. Nominal Orifice:
a. 1/2 inch, with discharge coefficient K between 5.3 and 5.8.
b. 17/32 inch with discharge coefficient K between 7.4 and 8.2.

G. Sprinkler Finishes: Chrome plated.

H. Special Coatings: Wax lead and corrosion-resistant paint.

I. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.
1. Ceiling Mounting: Chrome-plated steel, one piece, flat.

2. Sidewall Mounting: Plastic, white finish, one piece, flat.

J. Sprinkler Guards:

1. Standard: UL 199.
2. Type: Wire cage with fastening device for attaching to sprinkler.

2.9 ALARM DEVICES

A. Alarm-device types shall match piping and equipment connections.

B. Water-Motor-Operated Alarm:

1. Standard: UL 753.
2. Type: Mechanically operated, with Pelton wheel.
3. Alarm Gong: Cast aluminum with red-enamel factory finish.
4. Size: 8-1/2-inches diameter.
5. Components: Shaft length, bearings, and sleeve to suit wall construction.
6. Inlet: NPS 3/4.
7. Outlet: NPS 1 drain connection.

C. Electrically Operated Notification Appliances:

1. Electric Bell:
   a. Standard: UL 464.
   b. Type: Vibrating, metal alarm bell.
   c. Size: 6-inch minimum- diameter.
   d. Voltage: 120 V ac, 60 Hz, 1 phase.
   e. Finish: Red-enamel or polyester powder-coat factory finish, suitable for outdoor use with approved and listed weatherproof backbox.
2. Strobe/Horn:
   a. Standard: UL 464.
   b. Tone: Selectable, steady, Temporal-3 (T-3) in accordance with ISO 8201 and ANSI/ASA S3.41, 2400 Hz, electromechanical, broadband.
   c. Voltage: 120 V ac, 60 Hz.
   d. Effective Intensity: 110 cd.
   e. Finish: Red, suitable for outdoor use with approved and listed weatherproof backbox. White letters on housing identifying device as for "Fire."
   f. Sign, Integrated: Mount between backbox and strobe/horn with text visible on both sides, above and below strobe/horn. Housing to be shaped to cover surface-mounted weatherproof backbox. Sign is to consist of white lettering on red plastic identifying it as a "Sprinkler Fire Alarm" and instructing viewers to call 911, police, or fire department.

D. Water-Flow Indicators:

1. Standard: UL 346.
2. Water-Flow Detector: Electrically supervised.
3. Components: Two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
4. Type: Paddle operated.
5. Pressure Rating: 250 psig.
6. Design Installation: Horizontal or vertical.

E. Pressure Switches:

1. Standard: UL 346.

2. Type: Electrically supervised water-flow switch with retard feature.
3. Components: Single-pole, double-throw switch with normally closed contacts.
4. Design Operation: Rising pressure signals water flow.

F. Valve Supervisory Switches:

1. Standard: UL 346.
2. Type: Electrically supervised.
3. Components: Single-pole, double-throw switch with normally closed contacts.
4. Design: Signals that controlled valve is in other than fully open position.
5. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.10 MANUAL CONTROL STATIONS

A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide" for hydraulic operation, with union, NPS 1/2 pipe nipple, and bronze ball valve.

B. Include metal enclosure labeled "MANUAL CONTROL STATION," with operating instructions and cover held closed by breakable strut to prevent accidental opening.

2.11 CONTROL PANELS

A. Description: Single-area, two-area, or single-area cross-zoned control panel as indicated, including NEMA ICS 6, Type 1 enclosure, detector, alarm, and solenoid-valve circuitry for operation of deluge valves.

1. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide" when used with thermal detectors and Class A detector circuit wiring.
2. Electrical characteristics are 120-V ac, 60 Hz, with 24-V dc rechargeable batteries.
3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Manual Control Stations, Electric Operation: Metal enclosure, labeled "MANUAL CONTROL STATION," with operating instructions and cover held closed by breakable strut to prevent accidental opening.

C. Manual Control Stations, Hydraulic Operation: With union, NPS 1/2 pipe nipple, and bronze ball valve. Include metal enclosure labeled "MANUAL CONTROL STATION," with operating instructions and cover held closed by breakable strut to prevent accidental opening.

D. Panels Components:

1. Power supply.
2. Battery charger.
3. Standby batteries.
4. Field-wiring terminal strip.
5. Electrically supervised solenoid valves and polarized fire-alarm bell.
6. Lamp test facility.
7. Single-pole, double-throw auxiliary alarm contacts.
8. Rectifier.

2.12 PRESSURE GAUGES

A. Standard: UL 393.

B. Dial Size: 3-1/2- to 4-1/2-inch diameter.

C. Pressure Gauge Range: 0- to 250-psig minimum.

D. Label: Include "WATER" label on dial face.

PART 3 - EXECUTION

3.1 PREPARATION

A. Perform fire-hydrant flow test according to NFPA 13D and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.

B. Report test results promptly and in writing.

3.2 SERVICE-ENTRANCE PIPING

A. Connect sprinkler piping to water-service piping for service entrance to building. Comply with requirements for exterior piping in Section 21 11 00 "Facility Fire-Suppression Water-Service Piping" for exterior piping.

B. Install shutoff valve, backflow preventer, pressure gauge, drain, and other accessories indicated at connection to water-service piping.

C. Install shutoff valve, check valve, pressure gauge, and drain at connection to water service.

3.3 WATER-SUPPLY CONNECTIONS

A. Connect sprinkler piping to building's interior water-distribution piping. Comply with requirements for interior piping in Section 22 11 16 "Domestic Water Piping."

B. Install shutoff valve, backflow preventer, pressure gauge, drain, and other accessories indicated at connection to water-distribution piping.

C. Install shutoff valve, check valve, pressure gauge, and drain at connection to water supply.

3.4 PIPING INSTALLATION

A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated on approved working plans.

1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.

2. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

B. Piping Standard: Comply with NFPA 13D requirements for installation of sprinkler piping.

C. Install seismic restraints on piping. Comply with NFPA 13D requirements for seismic-restraint device materials and installation.

D. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

E. Install unions adjacent to each valve in pipes NPS 2 and smaller.

F. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

G. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13D.

H. Install sprinkler piping with drains for complete system drainage.

I. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.

J. Install automatic (ball drip) drain valve at each check valve for fire-department connection, to drain piping between fire-department connection and check valve. Install drain piping to and spill over floor drain or to outside building.

K. Install alarm devices in piping systems.

L. Install hangers and supports for sprinkler system piping according to NFPA 13D. Comply with requirements for hanger materials in NFPA 13D. In seismic-rated areas, refer to Section 21 05 48 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment."

M. Install pressure gauges on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gauges with connection not less than NPS 1/4 and with soft-metal seated globe valve, arranged for draining pipe between gauge and valve. Install gauges to permit removal, and install where they are not subject to freezing.

N. Pressurize and check preaction sprinkler system piping and air-pressure maintenance devices.

O. Fill sprinkler system piping with water.

P. Install electric heating cables and pipe insulation on sprinkler piping in areas subject to freezing. Comply with requirements for heating cables in Section 21 05 33 "Heat Tracing for Fire-Suppression Piping" and for piping insulation in Section 21 07 00 "Fire-Suppression Systems Insulation."

Q. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 21 05 17 "Sleeves and Sleeve Seals for Fire-Suppression Piping."

R. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 21 05 17 "Sleeves and Sleeve Seals for Fire-Suppression Piping."

S. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 21 05 18 "Escutcheons for Fire-Suppression Piping."

3.5 JOINT CONSTRUCTION

A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.

B. Install unions adjacent to each valve in pipes NPS 2 and smaller.

C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.

G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

H. Twist-Locked Joints: Insert plain end of steel pipe into plain-end-pipe fitting. Rotate retainer lugs one-quarter turn or tighten retainer pin.

I. Steel-Piping, Pressure-Sealed Joints: Join lightwall and Schedule 5 steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.

J. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.

1. Shop weld pipe joints where welded piping is indicated. Do not use welded joints for galvanized-steel pipe.

K. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.

L. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.

M. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" Chapter.

N. Copper-Tubing Grooved Joints: Roll rounded-edge groove in end of tube according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join copper tube and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.

O. Copper-Tubing, Pressure-Sealed Joints: Join copper tube and copper pressure-seal fittings with tools recommended by fitting manufacturer.

P. Extruded-Tee Connections: Form tee in copper tube according to ASTM F2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.

Q. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

R. Plastic-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.
2. CPVC Piping: Join according to ASTM D2846/D2846M Appendix.

3.6 INSTALLATION OF COVER SYSTEM FOR SPRINKLER PIPING

A. Install cover system, brackets, and cover components for sprinkler piping according to manufacturer's "Installation Manual" and NFPA 13D for supports.

3.7 VALVE AND SPECIALTIES INSTALLATION

A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13D and authorities having jurisdiction.

B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

D. Specialty Valves:

1. Install valves in vertical position for proper direction of flow, in main supply to system.
2. Install alarm valves with bypass check valve and retarding chamber drain-line connection.
3. Install deluge valves in vertical position, in proper direction of flow, and in main supply to deluge system. Install trim sets for drain, priming level, alarm connections, ball drip valves, pressure gauges, priming chamber attachment, and fill-line attachment.

E. Air Vent:

1. Provide at least one air vent at high point in each wet-pipe sprinkler system in accordance with NFPA 13D requirements. Connect vent into top of fire sprinkler piping.
2. Provide dielectric union for dissimilar metals, ball valve, and strainer upstream of automatic air vent.
3. Pipe from outlet of air vent to drain.

3.8 SPRINKLER INSTALLATION

A. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing.

B. Install sprinklers into flexible, sprinkler hose fittings, and install hose into bracket on ceiling grid.

3.9 IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13D.

B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

3.10 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3. Flush, test, and inspect sprinkler systems according to NFPA 13D, "Systems Acceptance" Chapter.
4. Energize circuits to electrical equipment and devices.
5. Coordinate with fire-alarm tests. Operate as required.
6. Coordinate with fire-pump tests. Operate as required.
7. Verify that equipment hose threads are same as local fire department equipment.

B. Sprinkler piping system will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.11 CLEANING

A. Clean dirt and debris from sprinklers.

B. Only sprinklers with their original factory finish are acceptable. Remove and replace any sprinklers that are painted or have any other finish than their original factory finish.

3.12 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain specialty valves and pressure-maintenance pumps].

3.13 PIPING SCHEDULE

A. Piping between Fire Department Connections and Check Valves: Galvanized, standard-weight steel pipe with grooved ends, grooved-end fittings, grooved-end-pipe couplings, and grooved joints.

B. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.

C. Copper-tube, extruded-tee connections may be used for tee branches in copper tubing instead of specified copper fittings. Branch-connection joints must be brazed.

D. Standard-pressure, wet-pipe sprinkler system, NPS 2 and smaller, shall be one of the following:

1. Standard-weight or Schedule 30, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
2. Standard-weight or Schedule 30, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
3. Standard-weight or Schedule 30, black-steel pipe with plain ends; uncoated, plain-end-pipe fittings; and twist-locked joints.
4. Standard-weight or Schedule 30, galvanized-steel pipe with plain ends; galvanized, plain-end-pipe fittings; and twist-locked joints.
5. Standard-weight or Schedule 30, black-steel pipe with cut- or roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
6. Standard-weight or Schedule 30, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
7. Standard-weight or Schedule 30, black-steel pipe with plain ends; steel welding fittings; and welded joints.
8. Thinwall Schedule 10 nonstandard OD, thinwall or hybrid black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
9. Thinwall Schedule 10 or hybrid black-steel pipe with plain ends; uncoated, plain-end-pipe fittings; and twist-locked joints.
10. Thinwall Schedule 10 nonstandard OD, thinwall or hybrid black-steel pipe with plain ends; welding fittings; and welded joints.
11. Type L, hard copper tube with plain ends; cast- or wrought-copper, solder-joint fittings; and brazed joints.

12. Type L, hard copper tube with plain ends; copper pressure-seal fittings; and pressure-sealed joints.
13. NPS 2, Type L, hard copper tube with roll-grooved ends; copper, grooved-end fittings; grooved-end-tube couplings; and grooved joints.

E. Standard-pressure, wet-pipe sprinkler system, NPS 2-1/2 to NPS 4, shall be one of the following:

1. Standard-weight or Schedule 30, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
2. Standard-weight or Schedule 30, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
3. Standard-weight or Schedule 30, black-steel pipe with cut- or roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
4. Standard-weight or Schedule 30, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
5. Standard-weight or Schedule 30, black-steel pipe with plain ends; steel welding fittings; and welded joints.
6. Thinwall Schedule 10 nonstandard OD, thinwall or hybrid black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
7. Thinwall Schedule 10 nonstandard OD, thinwall or hybrid black-steel pipe with plain ends; welding fittings; and welded joints.
8. Type L, hard copper tube with plain ends; cast- or wrought-copper, solder-joint fittings; and brazed joints.
9. Type L, hard copper tube with plain ends; copper pressure-seal fittings; and pressure-sealed joints.
10. Type L, hard copper tube with roll-grooved ends; copper, grooved-end fittings; grooved-end-tube couplings; and grooved joints.

F. Standard-pressure, wet-pipe sprinkler system, NPS 5 and larger, shall be one of the following:

1. Standard-weight or Schedule 30, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
2. Standard-weight or Schedule 30, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
3. Standard-weight or Schedule 30, black-steel pipe with cut- or roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
4. Standard-weight or Schedule 30, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
5. Standard-weight or Schedule 30, black-steel pipe with plain ends; steel welding fittings; and welded joints.
6. Thinwall Schedule 10 or hybrid black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
7. Thinwall Schedule 10 or hybrid black-steel pipe with plain ends; welding fittings; and welded joints.
8. Type L, hard copper tube with plain ends; cast- or wrought-copper, solder-joint fittings; and brazed joints.
9. Type L, hard copper tube with roll-grooved ends; copper, grooved-end fittings; grooved-end-tube couplings; and grooved joints.

3.14 SPRINKLER SCHEDULE

A. Use sprinkler types in subparagraphs below for the following applications:

1. Rooms without Ceilings: Upright sprinklers.
2. Rooms with Suspended Ceilings: Concealed sprinklers.
3. Wall Mounting: Sidewall sprinklers.
4. Spaces Subject to Freezing: Upright, pendent, dry sprinklers; and sidewall, dry sprinklers as indicated.
5. Special Applications: Extended-coverage, flow-control, and quick-response sprinklers where indicated Attic sprinklers Combustible concealed space sprinklers.

B. Provide sprinkler types in subparagraphs below with finishes indicated.

1. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
2. Flush Sprinklers: Bright chrome, with painted white escutcheon.
3. Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.
4. Residential Sprinklers: Dull chrome.
5. Upright Pendent and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.

END OF SECTION

SECTION 22 05 10 - BASIC MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this and the other sections of Division 22.

1.2 SUMMARY

A. This Section includes general administrative and procedural requirements for mechanical installations. The following administrative and procedural requirements are included in this Section to expand the requirements specified in Division 1:

1. Submittals.
2. Coordination drawings.
3. Record documents.
4. Maintenance manuals.
5. Rough-ins.
6. Mechanical installations.
7. Cutting and patching.

B. Related Sections: The following sections contain requirements that relate to this section:

1. Division 22 Section "BASIC MECHANICAL MATERIALS AND METHODS," for materials and methods common to the remainder of Division 22, plus general related specifications including:

a. Access to mechanical installations.

1.3 SUBMITTALS

A. General: Follow the procedures specified in Division 1 Section "SUBMITTALS."

B. Increase, by the quantity listed below, the number of mechanical related shop drawings, product data, and samples submitted, to allow for required distribution plus two copies of each submittal required, which will be retained by the Mechanical Consulting Engineer.

1. Shop Drawings - Initial Submittal: 1 additional blue- or black-line prints.
2. Shop Drawings - Final Submittal: 1 additional blue- or black-line prints.
3. Product Data: 1 additional copy of each item.
4. Samples: 1 addition as set.

C. Additional copies may be required by individual sections of these Specifications.

1.4 RECORD DOCUMENTS

A. Prepare record documents in accordance with the requirements in Division 1 Section "PROJECT CLOSEOUT." In addition to the requirements specified in Division 1, indicate the following installed conditions:

1. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
2. Approved substitutions, Contract Modifications, and actual equipment and materials installed.
3. Contract Modifications, actual equipment and materials installed.

1.5 MAINTENANCE MANUALS

A. Prepare maintenance manuals in accordance with Division 1 Section "PROJECT CLOSEOUT." In addition to the requirements specified in Division 1, include the following information for equipment items:

1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
2. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.

3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
4. Servicing instructions and lubrication charts and schedules.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

1.7 WARRANTIES

A. Warranties shall begin at date of final completion. All compressors shall include a minimum of five years warranty. One year warranty for labor, parts, units, etc. is required for all equipment. Additionally, Contractor is responsible for all preventative maintenance and routine service on installed equipment for the one year warranty period in order to maintain all factory/manufacturer warranties.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 ROUGH-IN

A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

3.2 MECHANICAL INSTALLATIONS

A. General: Sequence, coordinate, and integrate the various elements of mechanical systems, materials, and equipment. Comply with the following requirements:
1. Coordinate mechanical systems, equipment, and materials installation with other building components.
2. Verify all dimensions by field measurements.
3. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
4. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
5. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
6. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
7. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect.
8. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
9. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.
10. Install access panel or doors where units are concealed behind finished surfaces. Access panels and doors are specified in Division 8 Section "ACCESS DOORS" and Division 22 Section "BASIC MECHANICAL MATERIALS AND METHODS."
11. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

3.3 CUTTING AND PATCHING

A. General: Perform cutting and patching in accordance with Division 1 Section "CUTTING AND PATCHING." In addition to the requirements specified in Division 1, the following requirements apply:
   1. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.

B. Perform cutting, fitting, and patching of mechanical equipment and materials required to:
   1. Uncover Work to provide for installation of ill-timed Work.
   2. Remove and replace defective Work.
   3. Remove and replace Work not conforming to requirements of the Contract Documents.
   4. Remove samples of installed Work as specified for testing.
   5. Install equipment and materials in existing structures.
   6. Upon written instructions from the Architect, uncover and restore Work to provide for Architect/Engineer observation of concealed Work.

C. Cut, remove and legally dispose of selected mechanical equipment, components, and materials as indicated, including but not limited to removal of mechanical piping, heating units, plumbing fixtures and trim, and other mechanical items made obsolete by the new Work.

D. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

E. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.
   1. Patch existing finished surfaces and building components using new materials matching existing materials and experienced Installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched.
   2. Patch finished surfaces and building components using new materials specified for the original installation and experienced Installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched.

END OF SECTION

SECTION 22 05 11 - BASIC MECHANICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and the Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following basic mechanical materials and methods to complement other Division 22 Sections.

1. Piping materials and installation instructions common to most piping systems.
2. Concrete equipment base construction requirements.
3. Equipment nameplate data requirements.
4. Labeling and identifying mechanical systems and equipment is specified in Division 22.
5. Nonshrink grout for equipment installations.
6. Field-fabricated metal and wood equipment supports.
7. Installation requirements common to equipment specification Sections.
8. Mechanical demolition.
9. Cutting and patching.
10. Touchup painting and finishing.

1.3 DEFINITIONS

A. Pipe, pipe fittings, and piping include tube, tube fittings, and tubing.

B. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below the roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.

C. Exposed Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

D. Exposed Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

E. Concealed Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

F. Concealed Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants, but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end-caps. Maintain end-caps through shipping, storage, and handling to prevent pipe-end damage and prevent entrance of dirt, debris, and moisture.

B. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. When stored inside, do not exceed structural capacity of the floor.

C. Protect flanges, fittings, and piping specialties from moisture and dirt.

1.5 SEQUENCING AND SCHEDULING

A. Coordinate mechanical equipment installation with other building components.

B. Coordinate the installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning prior to closing in the building.

D. Coordinate connection of electrical services.

E. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and

controlling agencies.

F. Coordinate installation of identifying devices after completing covering and painting where devices are applied to surfaces. Install identifying devices prior to installing acoustical ceilings and similar concealment.

1.6 WARRANTIES

A. Warranties shall begin at date of substantial completion. All compressors shall include a minimum of five years warranty. One year warranty for labor, parts, units, etc. is required for all equipment. Additionally, Contractor is responsible for all preventative maintenance and routine service on installed equipment for the one year warranty period in order to maintain all factory/manufacturer warranties.

PART 2 - PRODUCTS

2.1 PIPE AND PIPE FITTINGS

A. Refer to individual piping system specification Sections for pipe and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.2 JOINING MATERIALS

A. Refer to individual piping system specification Sections in Division 22 for special joining materials not listed below.

B. Solder Filler Metal: ASTM B 32.

1. Alloy Sn95 or Alloy Sn94: Tin (approximately 95 percent) and silver (approximately 5 percent), having 0.10 percent lead content.
2. Alloy E: Tin (approximately 95 percent) and copper (approximately 5 percent), having 0.10 percent maximum lead content.
3. Alloy HA: Tin-antimony-silver-copper-zinc, having 0.10 percent maximum lead content.
4. Alloy HB: Tin-antimony-silver-copper-nickel, having 0.10 percent maximum lead content.

C. Brazing Filler Metals: AWS A5.8.

1. BCuP Series: Copper-phosphorus alloys.
2. BAg1: Silver alloy.

D. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

E. Solvent Cements: Manufacturer's standard solvents complying with the following:

1. Chlorinated Poly(Vinyl Chloride) (CPVC): ASTM F 493.
2. Poly(Vinyl Chloride) (PVC): ASTM D 2564.

F. Plastic Pipe Seals: ASTM F 477, elastomeric gasket.

G. Couplings: Iron body sleeve assembly, fabricated to match outside diameters of plain-end pressure pipes.

1. Sleeve: ASTM A 126, Class B, gray iron.
2. Followers: ASTM A 47 (ASTM A 47M), Grade 32510 or ASTM A 536 ductile iron.
3. Gaskets: Rubber.
4. Bolts and Nuts: AWWA C111.
5. Finish: Enamel paint.

2.3 IDENTIFYING DEVICES AND LABELS

A. General: Manufacturer's standard products of categories and types required for each application as referenced in other Division 22 Sections. Where more than one type is specified for listed application, selection is Installer's option, but provide single selection for each product category.

B. Equipment Nameplates: Metal nameplate with operational data engraved or stamped, permanently fastened to equipment.

1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power

characteristics, labels of tested compliances, and similar essential data.

2. Location: An accessible and visible location.

C. Stencils: Standard stencils, prepared for required applications with letter sizes conforming to recommendations of ASME A13.1 for piping and similar applications, but not less than 1-1/4-inch (30mm) -high letters for ductwork and not less than 3/4-inch (19mm) -high letters for access door signs and similar operational instructions.

1. Material: Brass.
2. Stencil Paint: Standard exterior type stenciling enamel; black, except as otherwise indicated; either brushing grade or pressurized spray-can form and grade.
3. Identification Paint: Standard identification enamel of colors indicated or, if not otherwise indicated for piping systems, comply with ASME A13.1 for colors.

D. Lettering and Graphics: Coordinate names, abbreviations, and other designations used in mechanical identification, with corresponding designations indicated. Use numbers, lettering, and wording indicated for proper identification and operation/maintenance of mechanical systems and equipment.

2.4 GROUT

A. Nonshrink, Nonmetallic Grout: ASTM C 1107, Grade B.

1. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi (34.50MPa), 28-day compressive strength.
3. Packaging: Premixed and factory-packaged.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS--COMMON REQUIREMENTS

A. General: Install piping as described below, except where system Sections specify otherwise. Individual piping system specification Sections in Division 22 specify piping installation requirements unique to the piping system.

B. General Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated, except where deviations to layout are approved on coordination drawings.

C. Install components having pressure rating equal to or greater than system operating pressure.

D. Install piping in concealed interior and exterior locations, except in equipment rooms and service areas.

E. Install piping free of sags and bends.

F. Install exposed interior and exterior piping at right angles or parallel to building walls. Diagonal runs are prohibited, except where indicated.

G. Install piping tight to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.

H. Install piping to allow application of insulation plus 1-inch (25mm) clearance around insulation.

I. Locate groups of pipes parallel to each other, spaced to permit valve servicing.

J. Install fittings for changes in direction and branch connections.

K. Install couplings according to manufacturer's printed instructions.

L. Sleeves are not required for core drilled holes.

M. Permanent sleeves are not required for holes formed by PE plastic (removable) sleeves.

N. Install sleeves for pipes passing through concrete and masonry walls, concrete floor and roof slabs, and where indicated.

1. Cut sleeves to length for mounting flush with both surfaces.
   a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level. Extend cast-iron sleeve fittings below

floor slab as required to secure clamping ring where specified.

2. Install large enough sleeves to provide 1/4-inch (6mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
   a. Steel Pipe Sleeves: For pipes smaller than 6 inches (150 mm).
3. Except for below-grade wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using elastomeric joint sealants specified in Division 7 Section "Joint Sealants."

O. Above Grade, Exterior Wall, Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeve for 1-inch (25mm) annular clear space between pipe and sleeve for installation of mechanical seals.
   1. Install steel pipe for sleeves smaller than 6 inches (150 mm).
   2. Install cast-iron wall pipes for sleeves 6 inches (150 mm) and larger.
   3. Assemble and install mechanical seals according to manufacturer's printed instructions.

P. Below Grade, Exterior Wall, Pipe Penetrations: Install ductile-iron wall penetration system sleeves according to manufacturer's printed installation instructions.

Q. Fire Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestopping sealant material. Firestopping materials are specified in Division 7 Section "Firestopping."

R. Verify final equipment locations for roughing in.

S. Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping system Sections.
   1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
   2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
   3. Soldered Joints: Construct joints according to AWS "Soldering Manual," Chapter 22 "The Soldering of Pipe and Tube."
   4. Brazed Joints: Construct joints according to AWS "Brazing Manual" in the "Pipe and Tube" chapter.
   5. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full inside diameter. Join pipe fittings and valves as follows:
      a. Note the internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
      b. Apply appropriate tape or thread compound to external pipe threads (except where dry seal threading is specified).
      c. Align threads at point of assembly.
      d. Tighten joint with wrench. Apply wrench to valve end into which pipe is being threaded.
      e. Damaged Threads: Do not use pipe or pipe fittings having threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

T. Piping Connections: Except as otherwise indicated, make piping connections as specified below.
   1. Install unions in piping 2 inches (50 mm) and smaller adjacent to each valve and at final connection to each piece of equipment having a 2-inch (50mm) or smaller threaded pipe connection.
   2. Wet Piping Systems (Water and Steam): Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.2 EQUIPMENT INSTALLATION--COMMON REQUIREMENTS

A. Install equipment to provide the maximum possible headroom where mounting heights are not indicated.

B. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to the Architect.

C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, except where otherwise indicated.

D. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. Connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.

E. Install equipment giving right-of-way to piping systems installed at a required slope.

3.3 LABELING AND IDENTIFYING

A. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.

1. Stenciled Markers: Complying with ASME A13.1.

B. Equipment: Install engraved plastic laminate sign or equipment marker on or near each major item of mechanical equipment.

1. Lettering Size: Minimum 1/4-inch (6mm) -high lettering for name of unit where viewing distance is less than 2 feet (0.6 m), 1/2-inch (13mm) -high for distances up to 6 feet (1.8 m), and proportionately larger lettering for greater distances. Provide secondary lettering 2/3 to 3/4 of size of principal lettering.

2. Text of Signs: Provide text to distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to name of identified unit.

C. Adjusting: Relocate identifying devices which become visually blocked by work of this Division or other Divisions.

3.4 PAINTING AND FINISHING

A. Damage and Touch Up: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.5 DEMOLITION

A. Disconnect, demolish, and remove work specified under Division 22 and as indicated.

B. Where pipe, ductwork, insulation, or equipment to remain is damaged or disturbed, remove damaged portions and install new products of equal capacity and quality.

C. Accessible Work: Remove indicated exposed pipe and ductwork in its entirety.

D. Abandoned Work: Cut and remove buried pipe abandoned in place, 2 inches (50 mm) beyond the face of adjacent construction. Cap and patch surface to match existing finish.

E. Removal: Remove indicated equipment from the Project site.

F. Temporary Disconnection: Remove, store, clean, reinstall, reconnect, and make operational equipment indicated for relocation.

3.6 CUTTING AND PATCHING

A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of the trades involved.

B. Repair cut surfaces to match adjacent surfaces.

3.7 GROUTING

A. Install nonmetallic nonshrink grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's printed instructions.

B. Clean surfaces that will come into contact with grout.

C. Provide forms for placement of grout, as required.

D. Avoid air entrapment when placing grout.

E. Place grout to completely fill equipment bases.

F. Place grout on concrete bases to provide a smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout according to manufacturer's printed instructions.

END OF SECTION

SECTION 22 05 13 - COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on alternating-current power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with NEMA MG 1 unless otherwise indicated.

B. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Premium efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.
2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Multispeed Motors: Separate winding for each speed.

F. Rotor: Random-wound, squirrel cage.

G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

H. Temperature Rise: Match insulation rating.

I. Insulation: Class F.

J. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
2. Motors Smaller Than 15 HP: Manufacturer's standard starting characteristic.

K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 ADDITIONAL REQUIREMENTS FOR POLYPHASE MOTORS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable-Frequency Controllers:

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width-modulated inverters.

2. Inverter-Duty Motors: Class F temperature rise; Class H insulation.

3. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

2.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.

2. Split phase.

3. Capacitor start, inductor run.

4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 22 05 17 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Sleeves.
2. Stack-sleeve fittings.
3. Sleeve-seal systems.
4. Sleeve-seal fittings.
5. Grout.
6. Silicone sealants.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Advance Products & Systems, Inc.
2. CALPICO, Inc.
3. GPT; an EnPro Industries company.

B. Cast-Iron Pipe Sleeves: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop collar.

C. Steel Pipe Sleeves: ASTM A53/A53M, Type E, Grade B, Schedule 40, anticorrosion coated or galvanized, with plain ends and integral welded waterstop collar.

D. Galvanized-Steel Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

E. PVC Pipe Sleeves: ASTM D1785, Schedule 40.

F. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

G. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

2.2 STACK-SLEEVE FITTINGS

A. Description: Manufactured, Dura-coated or Duco-coated galvanized cast-iron sleeve with integral clamping flange for use in waterproof floors and roofs. Include clamping ring, bolts, and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with setscrews.

2.3 SLEEVE-SEAL SYSTEMS

A. Description:

1. Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
2. Designed to form a hydrostatic seal of 20 psig minimum.
3. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

4. Pressure Plates: Carbon steel.
5. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, ASTM B633, Stainless steel of length required to secure pressure plates to sealing elements.

2.4 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall.

B. Plastic or rubber waterstop collar with center opening to match piping OD.

2.5 GROUT

A. Description: Nonshrink, for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.6 SILICONE SEALANTS

A. Silicone, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant, ASTM C920, Type S, Grade NS, Class 25, Use NT.

B. Silicone, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade P, Class 25, Uses T and NT. Grade P Pourable (self-leveling) formulation is for opening in floors and other horizontal surfaces that are not fire rated.

C. Silicone Foam: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
2. Cut sleeves to length for mounting flush with both surfaces.
    a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
3. Using grout or silicone sealant, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint.

E. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping and fill materials specified in Section 07 84 13 "Penetration Firestopping."

3.2 STACK-SLEEVE-FITTING INSTALLATION

A. Install stack-sleeve fittings in new slabs as slabs are constructed.

1. Install fittings that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.

2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section 07 62 00 "Sheet Metal Flashing and Trim."

3. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.

4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

5. Use silicone sealant to seal the space around outside of stack-sleeve fittings.

B. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping specified in Section 07 84 13 "Penetration Firestopping."

3.3 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.4 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Use grout or silicone sealant to seal the space around outside of sleeve-seal fittings.

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Leak Test: After allowing for a full cure, test sleeves and sleeve seals for leaks. Repair leaks and retest until no leaks exist.

B. Sleeves and sleeve seals will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.6 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls above Grade:

a. Piping Smaller Than NPS 6: Cast-iron pipe sleeves.

b. Piping NPS 6 and Larger: Cast-iron pipe sleeves.

2. Exterior Concrete Walls below Grade:

a. Piping Smaller Than NPS 6: Cast-iron pipe sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

b. Piping NPS 6 and Larger: Cast-iron pipe sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

3. Concrete Slabs-on-Grade:

a. Piping Smaller Than NPS 6: Cast-iron pipe sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

b. Piping NPS 6 and Larger: Cast-iron pipe sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

4. Concrete Slabs above Grade:

a. Piping Smaller Than NPS 6: Steel pipe sleeves.

b. Piping NPS 6 and Larger: Steel pipe sleeves.

5. Interior Partitions:

a. Piping Smaller Than NPS 6: Steel pipe sleeves.

b. Piping NPS 6 and Larger: Galvanized-steel sheet sleeves.

END OF SECTION

SECTION 22 05 18 - ESCUTCHEONS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Escutcheons.
2. Floor plates.

1.3 DEFINITIONS

A. Existing Piping to Remain: Existing piping that is not to be removed and that is not otherwise indicated to be removed and salvaged, or removed and reinstalled.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. BrassCraft Manufacturing Co.; a Masco company.
2. Dearborn Brass.
3. Jones Stephens Corp.
4. Keeney Manufacturing Company (The).
5. Mid-America Fittings, Inc.
6. ProFlo; a Ferguson Enterprises, Inc. brand.

2.2 ESCUTCHEONS

A. One-Piece, Steel Type: With polished, chrome-plated finish and setscrew fastener.

B. One-Piece, Stainless-Steel Type: With polished stainless-steel finish.

C. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.

D. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped steel with polished, chrome-plated finish and spring-clip fasteners.

E. One-Piece, Stamped-Steel Type: With polished, chrome-plated finish and spring-clip fasteners.

F. Split-Plate, Stamped-Steel Type: With polished, chrome-plated finish; concealed and exposed-rivet hinge; and spring-clip fasteners.

2.3 FLOOR PLATES

A. Split Floor Plates: Cast brass with concealed hinge.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.

1. Escutcheons for New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep pattern.

b. Chrome-Plated Piping: One-piece steel with polished, chrome-plated finish.

c. Insulated Piping: One-piece stamped steel or split-plate, stamped steel with concealed hinge or split-plate, stamped steel with exposed-rivet hinge with polished, chrome-plated finish.

d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece stamped steel or split-plate, stamped steel with concealed hinge or split-plate, stamped steel with exposed-rivet hinge with polished, chrome-plated finish.

e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece stamped steel or split-plate, stamped steel with concealed hinge or split-plate, stamped steel with exposed-rivet hinge with polished, chrome-plated finish.

f. Bare Piping in Unfinished Service Spaces: One-piece stamped steel or split-plate, stamped steel with concealed hinge or split-plate, stamped steel with exposed-rivet hinge with polished, chrome-plated finish.

g. Bare Piping in Equipment Rooms: One-piece stamped steel or split-plate, stamped steel with concealed hinge or split-plate, stamped steel with exposed-rivet hinge with polished, chrome-plated finish.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. New Piping: One-piece, floor plate.

2. Existing Piping: Split floor plate.

3.2 FIELD QUALITY CONTROL

A. Using new materials, replace broken and damaged escutcheons and floor plates.

END OF SECTION

SECTION 22 05 19 - METERS AND GAGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Bimetallic-actuated thermometers.
2. Filled-system thermometers.
3. Liquid-in-glass thermometers.
4. Light-activated thermometers.
5. Thermowells.
6. Dial-type pressure gages.
7. Gage attachments.
8. Test plugs.
9. Test-plug kits.
10. Sight flow indicators.

B. Related Requirements:

1. Section 22 11 13 "Facility Water Distribution Piping" for domestic water meters and combined domestic and fire-protection water-service meters outside the building.
2. Section 22 11 19 "Domestic Water Piping Specialties" for water meters.
3. Section 22 15 13 "General-Service Compressed-Air Piping" for compressed air gages.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of meter and gage.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 BIMETALLIC-ACTUATED THERMOMETERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ashcroft Inc.
2. Nanmac Corporation.
3. Trerice, H. O. Co.
4. WATTS.
5. Weiss Instruments, Inc.
6. WIKA Instrument Corporation.

B. Standard: ASME B40.200.

C. Case: Liquid-filled and sealed type(s); stainless steel with 3-inch nominal diameter.

D. Dial: Nonreflective aluminum with permanently etched scale markings and scales in deg F and deg C.

E. Connector Type(s): Union joint, adjustable angle rigid, back and rigid, bottom, with unified-inch screw threads.

F. Connector Size: 1/2 inch, with ASME B1.1 screw threads.

G. Stem: 0.25 or 0.375 inch in diameter; stainless steel.

H. Window: Plain glass or plastic.

I. Ring: Stainless steel.

J. Element: Bimetal coil.

K. Pointer: Dark-colored metal.

L. Accuracy: Plus or minus 1 percent of scale range.

2.2 FILLED-SYSTEM THERMOMETERS

A. Direct-Mounted, Metal-Case, Vapor-Actuated Thermometers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Ashcroft Inc.
   b. Trerice, H. O. Co.
   c. Weiss Instruments, Inc.
2. Standard: ASME B40.200.
3. Case: Sealed type, cast aluminum or drawn steel; 4-1/2-inch nominal diameter.
4. Element: Bourdon tube or other type of pressure element.
5. Movement: Mechanical, dampening type, with link to pressure element and connection to pointer.
6. Dial: Nonreflective aluminum with permanently etched scale markings graduated in deg F and deg C.
7. Pointer: Dark-colored metal.
8. Window: Glass or plastic.
9. Ring: Metal Stainless steel.
10. Connector Type(s): Union joint, adjustable, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device rigid, back and rigid, bottom; with ASME B1.1 screw threads.
11. Thermal System: Liquid-filled bulb in copper-plated steel, aluminum, or brass stem and of length to suit installation.
    a. Design for Thermowell Installation: Bare stem.
12. Accuracy: Plus or minus 1 percent of scale range.

B. Direct-Mounted, Plastic-Case, Vapor-Actuated Thermometers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Ashcroft Inc.
   b. Miljoco Corporation.
   c. REOTEMP Instrument Corporation.
2. Standard: ASME B40.200.
3. Case: Sealed type, plastic; 4-1/2-inch nominal diameter.
4. Element: Bourdon tube or other type of pressure element.
5. Movement: Mechanical, with link to pressure element and connection to pointer.
6. Dial: Nonreflective aluminum with permanently etched scale markings graduated in deg F and deg C.
7. Pointer: Dark-colored metal.
8. Window: Glass or plastic.
9. Ring: Metal or plastic.

10. Connector Type(s): Union joint, adjustable, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device rigid, back and rigid, bottom; with ASME B1.1 screw threads.
11. Thermal System: Liquid-filled bulb in copper-plated steel, aluminum, or brass stem and of length to suit installation.
    a. Design for Thermowell Installation: Bare stem.
12. Accuracy: Plus or minus 1 percent of scale range.

C. Remote-Mounted, Metal-Case, Vapor-Actuated Thermometers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Ashcroft Inc.
    b. Trerice, H. O. Co.
    c. Weiss Instruments, Inc.
    d. WIKA Instrument Corporation.
2. Standard: ASME B40.200.
3. Case: Sealed type, cast aluminum or drawn steel; 4-1/2-inch nominal diameter with back flange and holes for panel mounting.
4. Element: Bourdon tube or other type of pressure element.
5. Movement: Mechanical, with link to pressure element and connection to pointer.
6. Dial: Nonreflective aluminum with permanently etched scale markings graduated in deg F and deg C.
7. Pointer: Dark-colored metal.
8. Window: Glass or plastic.
9. Ring: Metal Stainless steel.
10. Connector Type(s): Union joint, back; with ASME B1.1 screw threads.
11. Thermal System: Liquid-filled bulb in copper-plated steel, aluminum, or brass stem and of length to suit installation.
    a. Design for Thermowell Installation: Bare stem.
12. Accuracy: Plus or minus 1 percent of scale range.

2.3 LIQUID-IN-GLASS THERMOMETERS

A. Metal-Case, Compact-Style, Liquid-in-Glass Thermometers:
1. Standard: ASME B40.200.
2. Case: Cast aluminum; 6-inch nominal size.
3. Case Form: Back angle unless otherwise indicated.
4. Tube: Glass with magnifying lens and blue or red organic liquid.
5. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F and deg C.
6. Window: Glass or plastic.
7. Stem: Aluminum or brass and of length to suit installation.
    a. Design for Thermowell Installation: Bare stem.
8. Connector: 3/4 inch, with ASME B1.1 screw threads.
9. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

B. Plastic-Case, Compact-Style, Liquid-in-Glass Thermometers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. WATTS.

b. Weiss Instruments, Inc.

c. Weksler Glass Thermometer Corp.

d. WIKA Instrument Corporation.

2. Standard: ASME B40.200.

3. Case: Plastic; 6-inch nominal size.

4. Case Form: Back angle unless otherwise indicated.

5. Tube: Glass with magnifying lens and blue or red organic liquid.

6. Tube Background: Nonreflective with permanently etched scale markings graduated in deg F and deg C.

7. Window: Glass or plastic.

8. Stem: Aluminum or brass and of length to suit installation.

a. Design for Thermowell Installation: Bare stem.

9. Connector: 3/4 inch, with ASME B1.1 screw threads.

10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

C. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:

1. Standard: ASME B40.200.

2. Case: Cast aluminum; 7-inch nominal size unless otherwise indicated.

3. Case Form: Adjustable angle Straight unless otherwise indicated.

4. Tube: Glass with magnifying lens and blue or red organic liquid.

5. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F and deg C.

6. Window: Glass or plastic.

7. Stem: Aluminum and of length to suit installation.

a. Design for Thermowell Installation: Bare stem.

8. Connector: 1-1/4 inches, with ASME B1.1 screw threads.

9. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

D. Plastic-Case, Industrial-Style, Liquid-in-Glass Thermometers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Marsh Bellofram.

b. WATTS.

c. Weiss Instruments, Inc.

d. Weksler Glass Thermometer Corp.

e. WIKA Instrument Corporation.

2. Standard: ASME B40.200.

3. Case: Plastic; 7-inch nominal size unless otherwise indicated.

4. Case Form: Adjustable angle unless otherwise indicated.

5. Tube: Glass with magnifying lens and blue or red organic liquid.

6. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F and deg C.

7. Window: Glass or plastic.

8. Stem: Aluminum] Aluminum, brass, or stainless steel and of length to suit installation.

a. Design for Thermowell Installation: Bare stem.

9. Connector: 1-1/4 inches, with ASME B1.1 screw threads.

10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

2.4 LIGHT-ACTIVATED THERMOMETERS

2.5 THERMOWELLS

A. Thermowells:

1. Standard: ASME B40.200.
2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
3. Material for Use with Copper Tubing: CNR or CUNI.
4. Material for Use with Steel Piping: CRES.
5. Type: Stepped shank unless straight or tapered shank is indicated.
6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.
7. Internal Threads: 1/2, 3/4, and 1 inch, with ASME B1.1 screw threads.
8. Bore: Diameter required to match thermometer bulb or stem.
9. Insertion Length: Length required to match thermometer bulb or stem.
10. Lagging Extension: Include on thermowells for insulated piping and tubing.
11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

B. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.6 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Ametek U.S. Gauge.
   b. Trerice, H. O. Co.
   c. WATTS.
   d. Weiss Instruments, Inc.
   e. Weksler Glass Thermometer Corp.
   f. WIKA Instrument Corporation.
2. Standard: ASME B40.100.
3. Case: Liquid-filled Sealed Open-front, pressure relief type(s); cast aluminum or drawn steel; 4-1/2-inch nominal diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
8. Pointer: Dark-colored metal.
9. Window: Glass or plastic.
10. Ring: Metal Stainless steel.
11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

2.7 GAGE ATTACHMENTS

A. Snubbers: ASME B40.100, brass; with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and piston porous-metal-type surge-dampening device. Include extension for use on insulated piping.

B. Valves: Brass ball, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads.

2.8 TEST PLUGS

A. Description: Test-station fitting made for insertion into piping tee fitting.

B. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.

C. Thread Size: NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe thread.

D. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.

E. Core Inserts: Chlorosulfonated polyethylene synthetic and EPDM self-sealing rubber.

2.9 TEST-PLUG KITS

A. Furnish one test-plug kit(s) containing one] thermometer(s), one pressure gage and adapter, and carrying case. Thermometer sensing elements, pressure gage, and adapter probes shall be of diameter to fit test plugs and of length to project into piping.

B. Low-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch-diameter dial and tapered-end sensing element. Dial range shall be at least 25 to 125 deg F.

C. Pressure Gage: Small, Bourdon-tube insertion type with 2- to 3-inch-diameter dial and probe. Dial range shall be at least 0 to 200 psig.

D. Carrying Case: Metal or plastic, with formed instrument padding.

2.10 SIGHT FLOW INDICATORS

A. Description: Piping inline-installation device for visual verification of flow.

B. Construction: Bronze or stainless-steel body, with sight glass and ball, flapper, or paddle wheel indicator, and threaded or flanged ends.

C. Minimum Pressure Rating: 150 psig.

D. Minimum Temperature Rating: 200 deg F.

E. End Connections for NPS 2 and Smaller: Threaded.

F. End Connections for NPS 2-1/2 and Larger: Flanged.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install thermowells with socket extending one-third of pipe diameter to center of pipe and in vertical position in piping tees.

B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.

C. Install thermowells with extension on insulated piping.

D. Fill thermowells with heat-transfer medium.

E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.

F. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks. Use minimum tubing length.

G. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.

H. Install remote-mounted pressure gages on panel.

I. Install valve and snubber in piping for each pressure gage for fluids.

J. Install test plugs in piping tees.

K. Install thermometers in the following locations:

1. Inlet and outlet of each water heater.
2. Inlets and outlets of each domestic water heat exchanger.
3. Inlet and outlet of each domestic hot-water storage tank.
4. Inlet and outlet of each remote domestic water chiller.
5. .

L. Install pressure gages in the following locations:

1. Building water service entrance into building.
2. Inlet and outlet of each pressure-reducing valve.
3. Suction and discharge of each domestic water pump.

3.2 CONNECTIONS

A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

3.3 ADJUSTING

A. Adjust faces of meters and gages to proper angle for best visibility.

3.4 THERMOMETER SCALE-RANGE SCHEDULE

A. Scale Range for Domestic Cold-Water Piping: 0 to 150 deg F and minus 20 to plus 70 deg C.

B. Scale Range for Domestic Hot-Water Piping: 0 to 250 deg F and 0 to 150 deg C.

END OF SECTION

SECTION 22 05 23.12 - BALL VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Brass ball valves.
2. Bronze ball valves.
3. Steel ball valves.
4. Iron ball valves.
5. CPVC ball valves.
6. PVC ball valves.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1. Certification that products comply with NSF 61and NSF 372.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, and soldered ends.
3. Set ball valves open to minimize exposure of functional surfaces.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use operating handles or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B1.20.1 for threads for threaded end valves.
2. ASME B16.1 for flanges on iron valves.
3. ASME B16.5 for flanges on steel valves.
4. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
5. ASME B16.18 for solder-joint connections.
6. ASME B31.9 for building services piping valves.

C. NSF Compliance: NSF 61 and NSF 372 for valve materials for potable-water service.

D. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

F. Valve Sizes: Same as upstream piping unless otherwise indicated.

G. Valve Actuator Types:

1. Gear Actuator: For quarter-turn valves NPS 4 and larger.
2. Handlever: For quarter-turn valves smaller than NPS 4.

H. Valves in Insulated Piping:

1. Include 2-inch stem extensions.
2. Extended operating handles of nonthermal-conductive material and protective sleeves that allow operation of valves without breaking vapor seals or disturbing insulation.
3. Memory stops that are fully adjustable after insulation is applied.

2.2 BRASS BALL VALVES

A. Brass Ball Valves, One-Piece:

1. Description:
   a. Standard: MSS SP-110.
   b. CWP Rating: 400 psig.
   c. Body Design: One piece.
   d. Body Material: Forged brass or bronze.
   e. Ends: Threaded and soldered.
   f. Seats: PTFE.
   g. Stem: Brass or stainless steel.
   h. Ball: Chrome-plated brass or stainless steel.
   i. Port: Reduced.

B. Brass Ball Valves, Two-Piece with Full Port and Brass Trim, Threaded or Soldered Ends:

1. Description:
   a. Standard: MSS SP-110 or MSS SP-145.
   b. CWP Rating: 600 psig.
   c. Body Design: Two piece.
   d. Body Material: Forged brass.
   e. Ends: Threaded and soldered.
   f. Seats: PTFE.
   g. Stem: Brass.
   h. Ball: Chrome-plated brass.
   i. Port: Full.

C. Brass Ball Valves, Two-Piece with Full Port and Brass Trim, Press Ends:

1. Description:
   a. Standard: MSS SP-110 or MSS SP-145.
   b. CWP Rating: Minimum 200 psig.
   c. Body Design: Two piece.
   d. Body Material: Forged brass.
   e. Ends: Press.
   f. Press Ends Connections Rating: Minimum 200 psig.
   g. Seats: PTFE or RPTFE.
   h. Stem: Brass.
   i. Ball: Chrome-plated brass.
   j. Port: Full.
   k. O-Ring Seal: Buna-N or EPDM.

D. Brass Ball Valves, Two-Piece with Full Port and Stainless-Steel Trim, Threaded or Soldered Ends:
   1. Description:
      a. Standard: MSS SP-110 or MSS SP-145.
      b. CWP Rating: 600 psig.
      c. Body Design: Two piece.
      d. Body Material: Forged brass.
      e. Ends: Threaded and soldered.
      f. Seats: PTFE.
      g. Stem: Stainless steel.
      h. Ball: Stainless steel, vented.
      i. Port: Full.

E. Brass Ball Valves, Two-Piece with Full Port and Stainless-Steel Trim, Press Ends:
   1. Description:
      a. Standard: MSS SP-110 or MSS SP-145.
      b. CWP Rating: Minimum 200 psig.
      c. Body Design: Two piece.
      d. Body Material: Forged brass.
      e. Ends: Press.
      f. Press Ends Connections Rating: Minimum 200 psig.
      g. Seats: PTFE or RPTFE.
      h. Stem: Stainless steel.
      i. Ball: Stainless steel, vented.
      j. Port: Full.
      k. O-Ring Seal: Buna-N or EPDM.

F. Brass Ball Valves, Two-Piece with Regular Port and Brass Trim:
   1. Description:
      a. Standard: MSS SP-110.
      b. CWP Rating: 600 psig.
      c. Body Design: Two piece.
      d. Body Material: Forged brass.
      e. Ends: Threaded and soldered.
      f. Seats: PTFE.
      g. Stem: Brass.
      h. Ball: Chrome-plated brass.
      i. Port: Regular.

G. Brass Ball Valves, Two-Piece with Regular Port and Stainless-Steel Trim:
   1. Description:
      a. Standard: MSS SP-110.
      b. CWP Rating: 600 psig.
      c. Body Design: Two piece.
      d. Body Material: Brass or bronze.
      e. Ends: Threaded and soldered.
      f. Seats: PTFE.
      g. Stem: Stainless steel.

h. Ball: Stainless steel, vented.
i. Port: Regular.

H. Brass Ball Valves, Three-Piece with Full Port and Brass Trim:
1. Description:
a. Standard: MSS SP-110.
b. CWP Rating: 600 psig.
c. Body Design: Three piece.
d. Body Material: Forged brass.
e. Ends: Threaded and soldered.
f. Seats: PTFE.
g. Stem: Brass.
h. Ball: Chrome-plated brass.
i. Port: Full.

I. Brass Ball Valves, Three-Piece with Full Port and Stainless-Steel Trim:
1. Description:
a. Standard: MSS SP-110.
b. CWP Rating: 600 psig.
c. Body Design: Three piece.
d. Body Material: Forged brass.
e. Ends: Threaded and soldered.
f. Seats: PTFE.
g. Stem: Stainless steel.
h. Ball: Stainless steel, vented.
i. Port: Full.

2.3 BRONZE BALL VALVES

A. Bronze Ball Valves, One-Piece with Bronze Trim:
1. Description:
a. Standard: MSS SP-110.
b. CWP Rating: 400 psig.
c. Body Design: One piece.
d. Body Material: Bronze.
e. Ends: Threaded.
f. Seats: PTFE.
g. Stem: Bronze.
h. Ball: Chrome-plated brass.
i. Port: Reduced.

B. Bronze Ball Valves, One-Piece with Stainless-Steel Trim:
1. Description:
a. Standard: MSS SP-110.
b. CWP Rating: 600 psig.
c. Body Design: One piece.
d. Body Material: Bronze.
e. Ends: Threaded.
f. Seats: PTFE.

g. Stem: Stainless steel.
h. Ball: Stainless steel, vented.
i. Port: Reduced.

C. Bronze Ball Valves, Two-Piece with Full Port, and Bronze or Brass Trim, Threaded or Soldered Ends:
1. Description:
a. Standard: MSS SP-110 or MSS-145.
b. CWP Rating: 600 psig.
c. Body Design: Two piece.
d. Body Material: Bronze.
e. Ends: Threaded and soldered.
f. Seats: PTFE.
g. Stem: Bronze or brass.
h. Ball: Chrome-plated brass.
i. Port: Full.

D. Bronze Ball Valves, Two-Piece with Full Port, and Bronze or Brass Trim, Press Ends:
1. Description:
a. Standard: MSS SP-110 or MSS-145.
b. CWP Rating: Minimum 200 psig.
c. Body Design: Two piece.
d. Body Material: Bronze.
e. Ends: Press.
f. Press Ends Connections Rating: Minimum 200 psig.
g. Seats: PTFE or RTPFE.
h. Stem: Bronze or brass.
i. Ball: Chrome-plated brass.
j. Port: Full.
k. O-Ring Seal: EPDM or Buna-N.

E. Bronze Ball Valves, Two-Piece with Full Port and Stainless-Steel Trim:
1. Description:
a. Standard: MSS SP-110 or MSS-145.
b. CWP Rating: 600 psig.
c. Body Design: Two piece.
d. Body Material: Bronze.
e. Ends: Threaded or soldered.
f. Seats: PTFE.
g. Stem: Stainless steel.
h. Ball: Stainless steel, vented.
i. Port: Full.

F. Bronze Ball Valves, Two-Piece with Regular Port and Bronze or Brass Trim:
1. Description:
a. Standard: MSS SP-110.
b. CWP Rating: 600 psig.
c. Body Design: Two piece.
d. Body Material: Bronze.

e. Ends: Threaded.
f. Seats: PTFE.
g. Stem: Bronze or brass.
h. Ball: Chrome-plated brass.
i. Port: Regular.

G. Bronze Ball Valves, Two-Piece with Regular Port and Stainless-Steel Trim:
1. Description:
a. Standard: MSS SP-110.
b. CWP Rating: 600 psig.
c. Body Design: Two piece.
d. Body Material: Bronze.
e. Ends: Threaded.
f. Seats: PTFE.
g. Stem: Stainless steel.
h. Ball: Stainless steel, vented.
i. Port: Regular.

H. Bronze Ball Valves, Three-Piece with Full Port and Bronze or Brass Trim:
1. Description:
a. Standard: MSS SP-110.
b. CWP Rating: 600 psig.
c. Body Design: Three piece.
d. Body Material: Bronze.
e. Ends: Threaded.
f. Seats: PTFE.
g. Stem: Bronze or brass.
h. Ball: Chrome-plated brass.
i. Port: Full.

I. Bronze Ball Valves, Three-Piece with Full Port and Stainless-Steel Trim:
1. Description:
a. Standard: MSS SP-110.
b. CWP Rating: 600 psig.
c. Body Design: Three piece.
d. Body Material: Bronze.
e. Ends: Threaded.
f. Seats: PTFE.
g. Stem: Stainless steel.
h. Ball: Stainless steel, vented.
i. Port: Full.

J. Bronze Ball Valves, Three-Piece with Regular Port and Bronze Trim:
1. Description:
a. Standard: MSS SP-110.
b. CWP Rating: 600 psig.
c. Body Design: Three piece
d. Body Material: Bronze

e. Ends: Threaded or soldered.
f. Seats: PTFE.
g. Stem: Bronze.
h. Ball: Chrome-plated brass.
i. Port: Regular.

K. Bronze Ball Valves, Three-Piece with Regular Port and Stainless-Steel Trim:
1. Description:
a. Standard: MSS SP-110.
b. CWP Rating: 600 psig.
c. Body Design: Three piece.
d. Body Material: Bronze.
e. Ends: Threaded or soldered.
f. Seats: PTFE.
g. Stem: Stainless steel.
h. Ball: Stainless steel, vented.
i. Port: Regular.

L. Bronze Ball Valves, Two-Piece, Safety-Exhaust:
1. Description:
a. Standard: MSS SP-110.
b. CWP Rating: 600 psig.
c. Body Design: Two piece.
d. Body Material: Bronze, ASTM B584, Alloy C844.
e. Ends: Threaded.
f. Seats: PTFE.
g. Stem: Stainless steel.
h. Ball: Chrome-plated brass, with exhaust vent opening for pneumatic applications.
i. Port: Full.

2.4 STEEL BALL VALVES

A. Steel Ball Valves with Full Port, Class 150:
1. Description:
a. Standard: MSS SP-72.
b. CWP Rating: 285 psig.
c. Body Design: Split body.
d. Body Material: Carbon steel, ASTM A216, Type WCB.
e. Ends: Flanged or threaded.
f. Seats: PTFE.
g. Stem: Stainless steel.
h. Ball: Stainless steel, vented.
i. Port: Full.

B. Steel Ball Valves with Regular Port, Class 150:
1. Description:
a. Standard: MSS SP-72.
b. CWP Rating: 285 psig.
c. Body Design: Uni-body.

d. Body Material: Carbon steel, ASTM A216, Type WCB.
e. Ends: Flanged or threaded.
f. Seats: PTFE.
g. Stem: Stainless steel.
h. Ball: Stainless steel, vented.
i. Port: Regular.

2.5 IRON BALL VALVES

A. Iron Ball Valves, Class 125:
1. Description:
a. Standard: MSS SP-72.
b. CWP Rating: 200 psig.
c. Body Design: Split body.
d. Body Material: ASTM A126, gray iron.
e. Ends: Flanged or threaded.
f. Seats: PTFE.
g. Stem: Stainless steel.
h. Ball: Stainless steel.
i. Port: Full.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
C. Examine threads on valve and mating pipe for form and cleanliness.
D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
B. Locate valves for easy access and provide separate support where necessary.
C. Install valves in horizontal piping with stem at or above center of pipe.
D. Install valves in position to allow full stem movement.
E. Install valve tags. Comply with requirements in Section 22 05 53 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

3.3 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.
B. Select valves with the following end connections:
1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option or press-end option is indicated in valve schedules below.
2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
3. For Copper Tubing, NPS 5 and Larger: Flanged ends.

4. For Steel Piping, NPS 2 and Smaller: Threaded ends.
5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
6. For Steel Piping, NPS 5 and Larger: Flanged ends.

3.4 LOW-PRESSURE, COMPRESSED-AIR VALVE SCHEDULE (150 PSIG OR LESS)

A. Pipe NPS 2 and Smaller:
1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
2. Brass ball valves, one piece.
3. Bronze ball valves, one piece with bronze trim.
4. Brass ball valves, two-piece with full port and stainless steel trim.
5. Bronze ball valves, two-piece with full port and stainless steel trim.
6. Brass ball valves, three-piece with full port and stainless steel trim.
7. Bronze ball valve, three-piece with full port and bronze or brass trim.
8. Bronze ball valves, two-piece with regular port and bronze trim.

B. Pipe NPS 2-1/2 and Larger:
1. Steel and Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
2. Steel ball valves, Class 150 with full port.
3. Iron ball valves, Class 150.

3.5 HIGH-PRESSURE, COMPRESSED-AIR VALVE SCHEDULE (150 TO 200 PSIG

A. Pipe NPS 2 and Smaller:
1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
2. Brass ball valve.
3. Bronze ball valve, one piece with stainless steel trim.
4. Brass ball valves, two-piece with full port and stainless steel trim.
5. Bronze ball valves, two-piece with full port and stainless steel trim.
6. Brass ball valves, three-piece with full port and stainless steel trim.
7. Bronze ball valves, three-piece with full port and stainless steel trim.
8. Bronze ball valves, two-piece with regular port and stainless steel trim.

B. Pipe NPS 2-1/2 and Larger:
1. Steel and Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
2. Steel ball valves, Class 150 with full port.
3. Iron ball valves, Class 150.

3.6 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:
1. Brass ball valve, one piece. Provide with threaded or solder-joint ends.
2. Bronze ball valve, one piece with bronze trim. Provide with threaded or solder-joint ends.
3. Brass ball valves, two-piece with full port and stainless steel trim. Provide with threaded, solder or press connection-joint ends.
4. Bronze ball valves, two-piece with full port and stainless steel trim. Provide with threaded, solder or press connection-joint ends.
5. Brass ball valves, three-piece with full port and stainless steel trim.
6. Bronze ball valves, three-piece with full port and stainless steel trim.

7. Bronze ball valves, two-piece with regular port and stainless-steel trim.

B. Pipe NPS 2-1/2 and Larger:

1. Steel and Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
2. Steel ball valves, Class 150 with full port.
3. Iron ball valves, Class 150.

END OF SECTION

SECTION 22 05 23.14 - CHECK VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Bronze lift check valves.
2. Bronze swing check valves.
3. Bronze swing check valves, press ends.
4. Iron swing check valves.
5. Iron swing check valves with closure control.
6. Iron, grooved-end swing check valves.
7. Iron, center-guided check valves.
8. Iron, plate-type check valves.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene-diene terpolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1. Certification that products comply with NSF 61 and NSF 372.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set check valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B1.20.1 for threads for threaded end valves.
2. ASME B16.1 for flanges on iron valves.
3. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
4. ASME B16.18 for solder joint.
5. ASME B31.9 for building services piping valves.

C. AWWA Compliance: Comply with AWWA C606 for grooved-end connections.

D. Drinking Water System Components - Health Effects and Drinking Water System Components - Lead Content Compliance: NSF 61 and NSF 372.

E. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

F. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

G. Valve Sizes: Same as upstream piping unless otherwise indicated.

H. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE LIFT CHECK VALVES

A. Bronze Lift Check Valves with Bronze Disc, Class 125:

a. Standard: MSS SP-80, Type 1.

b. CWP Rating: 200 psig.

c. Body Design: Vertical flow.

d. Body Material: ASTM B61 or ASTM B62, bronze.

e. Ends: Threaded or soldered. See valve schedule articles.

f. Disc: Bronze.

B. Bronze Lift Check Valves with Nonmetallic Disc, Class 125:

a. Standard: MSS SP-80, Type 2.

b. CWP Rating: 200 psig.

c. Body Design: Vertical flow.

d. Body Material: ASTM B61 or ASTM B62, bronze.

e. Ends: Threaded or soldered. See valve schedule articles.

f. Disc: NBR, PTFE.

2.3 BRONZE SWING CHECK VALVES

A. Bronze Swing Check Valves with Bronze Disc, Class 125:

a. Standard: MSS SP-80, Type 3.

b. CWP Rating: 200 psig.

c. Body Design: Horizontal flow.

d. Body Material: ASTM B62, bronze.

e. Ends: Threaded or soldered. See valve schedule articles.

f. Disc: Bronze.

B. Bronze Swing Check Valves with Nonmetallic Disc, Class 125:

1. Description:

a. Standard: MSS SP-80, Type 4.

b. CWP Rating: 200 psig.

c. Body Design: Horizontal flow.

d. Body Material: ASTM B62, bronze.

e. Ends: Threaded or soldered. See valve schedule articles.

f. Disc: PTFE.

C. Bronze Swing Check Valves with Bronze Disc, Class 150:

1. Description:

a. Standard: MSS SP-80, Type 3.

b. CWP Rating: 300 psig.

c. Body Design: Horizontal flow.

d. Body Material: ASTM B62, bronze.

e. Ends: Threaded or soldered. See valve schedule articles.
f. Disc: Bronze.

D. Bronze Swing Check Valves with Nonmetallic Disc, Class 150:
1. Description:
a. Standard: MSS SP-80, Type 4.
b. CWP Rating: 300 psig.
c. Body Design: Horizontal flow.
d. Body Material: ASTM B62, bronze.
e. Ends: Threaded or soldered. See valve schedule articles.
f. Disc: PTFE.

E. Bronze Swing Check Valves, Press Ends:
1. Description:
a. Standard: MSS SP-80 and MSS SP-139.
b. CWP Rating: Minimum 200 psig.
c. Body Design: Horizontal flow.
d. Body Material: ASTM B584, bronze.
e. Ends: Press.
f. Press Ends Connection Rating: Minimum 200 psig
g. Disc: Brass or bronze.

2.4 IRON SWING CHECK VALVES

A. Iron Swing Check Valves with Metal Seats, Class 125:
1. Description:
a. Standard: MSS SP-71, Type I.
b. CWP Rating: 200 psig.
c. Body Design: Clear or full waterway.
d. Body Material: ASTM A126, gray iron with bolted bonnet.
e. Ends: Flanged or threaded. See valve schedule articles.
f. Trim: Bronze.
g. Gasket: Asbestos free.

B. Iron Swing Check Valves with Nonmetallic-to-Metal Seats, Class 125:
1. Description:
a. Standard: MSS SP-71, Type I.
b. CWP Rating: 200 psig.
c. Body Design: Clear or full waterway.
d. Body Material: ASTM A126, gray iron with bolted bonnet.
e. Ends: Flanged or threaded. See valve schedule articles.
f. Trim: Composition.
g. Seat Ring: Bronze.
h. Disc Holder: Bronze.
i. Disc: PTFE.
j. Gasket: Asbestos free.

C. Iron Swing Check Valves with Metal Seats, Class 250:
1. Description:
a. Standard: MSS SP-71, Type I.

b. CWP Rating: 500 psig.
c. Body Design: Clear or full waterway.
d. Body Material: ASTM A126, gray iron with bolted bonnet.
e. Ends: Flanged or threaded. See valve schedule articles.
f. Trim: Bronze.
g. Gasket: Asbestos free.

2.5 IRON SWING CHECK VALVES WITH CLOSURE CONTROL

A. Iron Swing Check Valves with Lever- and Spring-Closure Control, Class 125:
1. Description:
a. Standard: MSS SP-71, Type I.
b. CWP Rating: 200 psig.
c. Body Design: Clear or full waterway.
d. Body Material: ASTM A126, gray iron with bolted bonnet.
e. Ends: Flanged or threaded. See valve schedule articles.
f. Trim: Bronze.
g. Gasket: Asbestos free.
h. Closure Control: Factory-installed exterior lever and weight.

B. Iron Swing Check Valves with Lever and Weight-Closure Control, Class 125:
1. Description:
a. Standard: MSS SP-71, Type I.
b. CWP Rating: 200 psig.
c. Body Design: Clear or full waterway.
d. Body Material: ASTM A126, gray iron with bolted bonnet.
e. Ends: Flanged or threaded. See valve schedule articles.
f. Trim: Bronze.
g. Gasket: Asbestos free.
h. Closure Control: Factory-installed exterior lever and weight.

2.6 IRON, GROOVED-END SWING CHECK VALVES

A. Iron, Grooved-End Swing Check Valves, 300 CWP:
1. Description:
a. CWP Rating: 300 psig.
b. Body Material: ASTM A536, ductile iron.
c. Seal: EPDM.
d. Disc: Spring operated, ductile iron or stainless steel.

2.7 IRON, CENTER-GUIDED, SPRING-LOADED CHECK VALVES

A. Iron, Compact-Wafer, Center-Guided Check Valves with Metal Seat, Class 125:
1. Description:
a. Standard: MSS SP-125.
b. CWP Rating: 200 psig.
c. Body Material: ASTM A126, gray iron.
d. Style: Compact wafer, spring loaded.
e. Seat: Bronze.

B. Iron Globe, Center-Guided Check Valves with Metal Seat, Class 125:
1. Description:

a. Standard: MSS SP-125.
b. CWP Rating: 200 psig.
c. Body Material: ASTM A126, gray iron.
d. Style: Globe, spring loaded.
e. Ends: Flanged.
f. Seat: Bronze.

C. Iron, Compact-Wafer, Center-Guided Check Valves with Metal Seat, Class 150:
1. Description:
a. Standard: MSS SP-125.
b. CWP Rating: 300 psig.
c. Body Material: ASTM A395/A395M or ASTM A536, ductile iron.
d. Style: Compact wafer, spring loaded.
e. Seat: Bronze.

D. Iron Globe, Center-Guided Check Valves with Metal Seat, Class 150:
1. Description:
a. Standard: MSS SP-125.
b. CWP Rating: 300 psig.
c. Body Material: ASTM A395/A395M or ASTM A536, ductile iron.
d. Style: Globe, spring loaded.
e. Ends: Flanged.
f. Seat: Bronze.

E. Iron, Compact-Wafer, Center-Guided Check Valves with Metal Seat, Class 250:
1. Description:
a. Standard: MSS SP-125.
b. CWP Rating: 400 psig.
c. Body Material: ASTM A126, gray iron.
d. Style: Compact wafer, spring loaded.
e. Seat: Bronze.

F. Iron Globe, Center-Guided Check Valves with Metal Seat, Class 250:
1. Description:
a. Standard: MSS SP-125.
b. CWP Rating: 400 psig.
c. Body Material: ASTM A126, gray iron.
d. Style: Globe, spring loaded.
e. Ends: Flanged.
f. Seat: Bronze.

G. Iron, Compact-Wafer, Center-Guided Check Valves with Metal Seat, Class 300:
1. Description:
a. Standard: MSS SP-125.
b. CWP Rating: 500 psig.
c. Body Material: ASTM A395/A395M or ASTM A536, ductile iron.
d. Style: Compact wafer, spring loaded.
e. Seat: Bronze.

H. Iron Globe, Center-Guided Check Valves with Metal Seat, Class 300:

1. Description:
    a. Standard: MSS SP-125.
    b. CWP Rating: 500 psig.
    c. Body Material: ASTM A395/A395M or ASTM A536, ductile iron.
    d. Style: Globe, spring loaded.
    e. Ends: Flanged.
    f. Seat: Bronze.

I. Iron, Compact-Wafer, Center-Guided Check Valves with Resilient Seat, Class 125:
1. Description:
    a. Standard: MSS SP-125.
    b. CWP Rating: 200 psig.
    c. Body Material: ASTM A126, gray iron.
    d. Style: Compact wafer, spring loaded.
    e. Seat: EPDM or NBR.

J. Iron Globe, Center-Guided Check Valves with Resilient Seat, Class 125:
1. Description:
    a. Standard: MSS SP-125.
    b. CWP Rating: 200 psig.
    c. Body Material: ASTM A126, gray iron.
    d. Style: Globe, spring loaded.
    e. Ends: Flanged.
    f. Seat: EPDM or NBR.

K. Iron, Compact-Wafer, Center-Guided Check Valves with Resilient Seat, Class 150:
1. Description:
    a. Standard: MSS SP-125.
    b. CWP Rating: 300 psig.
    c. Body Material: ASTM A395/A395M or ASTM A536, ductile iron.
    d. Style: Compact wafer, spring loaded.
    e. Seat: EPDM or NBR.

L. Iron, Globe, Center-Guided Check Valves with Resilient Seat, Class 150:
1. Description:
    a. Standard: MSS SP-125.
    b. CWP Rating: 300 psig.
    c. Body Material: ASTM A395/A395M or ASTM A536, ductile iron.
    d. Style: Globe, spring loaded.
    e. Ends: Flanged.
    f. Seat: EPDM or NBR.

M. Iron, Compact-Wafer, Center-Guided Check Valves with Resilient Seat, Class 250:
1. Description:
    a. Standard: MSS SP-125.
    b. CWP Rating: 400 psig.
    c. Body Material: ASTM A126, gray iron.
    d. Style: Compact wafer, spring loaded.
    e. Seat: EPDM or NBR.

N. Iron, Compact-Wafer, Center-Guided Check Valves with Resilient Seat, Class 300:
   1. Description:
      a. Standard: MSS SP-125.
      b. CWP Rating: 500 psig.
      c. Body Material: ASTM A395/A395M or ASTM A536, ductile iron.
      d. Style: Compact wafer, spring loaded.
      e. Seat: EPDM or NBR.

O. Iron Globe, Center-Guided Check Valves with Resilient Seat, Class 300:
   1. Description:
      a. Standard: MSS SP-125.
      b. CWP Rating: 500 psig.
      c. Body Material: ASTM A395/A395M or ASTM A536, ductile iron.
      d. Style: Globe, spring loaded.
      e. Ends: Flanged.
      f. Seat: EPDM or NBR.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Check Valves: Install check valves for proper direction of flow.
   1. Swing Check Valves: In horizontal position with hinge pin level.
   2. Center-Guided Check Valves: In horizontal or vertical position, between flanges.
   3. Lift Check Valves: With stem upright and plumb.

F. Install valve tags. Comply with requirements in Section 22 05 53 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:
   1. Pump-Discharge Check Valves:
      a. NPS 2 and Smaller: Bronze swing check valves with bronze disc.

b. NPS 2-1/2 and Larger for Domestic Water: Iron swing check valves with lever and weight or spring; or iron, center-guided, metal-seat or resilient-seat check valves.

c. NPS 2-1/2 and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.

B. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.

C. End Connections:

1. For Copper Tubing, NPS 2 and Smaller: Threaded or soldered or press-ends.
2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged or threaded.
3. For Copper Tubing, NPS 5 and Larger: Flanged.
4. For Steel Piping, NPS 2 and Smaller: Threaded.
5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged or threaded.
6. For Steel Piping, NPS 5 and Larger: Flanged.
7. For Grooved-End Copper Tubing and Steel Piping: Grooved.

3.5 LOW-PRESSURE, COMPRESSED-AIR VALVE SCHEDULE (150 PSIG OR LESS)

A. Pipe NPS 2 and Smaller:

1. Vertical, Upflow Applications Only: Bronze lift check valves with bronze nonmetallic disc, Class 125, with soldered or threaded end connections.
2. Horizontal and Vertical Applications: Bronze swing check valves with bronze nonmetallic disc, Class 150, with soldered or threaded end connections.

B. Pipe NPS 2-1/2 and Larger:

1. Iron swing check valves with metalseats, Class 125, with threaded or flanged end connections.
2. Iron, grooved-end swing check valves, 300 CWP.
3. Iron, dual-plate check valves with metal resilient seat, Class 125, with threaded or flanged end connections.
4. Iron, single-plate check valves with resilient seat, Class 125, with threaded or flanged end connections.

3.6 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Bronze swing check valves with bronze disc, Class 125, with soldered or threaded end connections.

B. Pipe NPS 2-1/2 and Larger:

1. Iron swing check valves with nonmetallic-to-metal seats, Class 250, with threaded or flanged end connections.
2. Iron, grooved-end swing check valves, 300 CWP.

END OF SECTION

SECTION 22 05 23.15 - GATE VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Bronze gate valves.
2. Iron gate valves.
3. CPVC gate valves.
4. PVC gate valves.
5. Chainwheels.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

B. NRS: Nonrising stem.

C. OS&Y: Outside screw and yoke.

D. RS: Rising stem.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1. Certification that products comply with NSF 61 and NSF 372.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set gate valves closed to prevent rattling.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B1.20.1 for threads for threaded end valves.
2. ASME B16.1 for flanges on iron valves.
3. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
4. ASME B16.18 for solder joint.
5. ASME B31.9 for building services piping valves.

C. NSF Compliance: NSF 61 and NSP 372 for valve materials for potable-water service.

D. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

F. Valve Sizes: Same as upstream piping unless otherwise indicated.

G. RS Valves in Insulated Piping: With 2-inch stem extensions.

H. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE GATE VALVES

A. Bronze Gate Valves, NRS, Class 125:

1. Description:

a. Standard: MSS SP-80, Type 1.

b. CWP Rating: 200 psig.

c. Body Material: Bronze with integral seat and screw-in bonnet.

d. Ends: Threaded or solder joint.

e. Stem: Bronze.

f. Disc: Solid wedge; bronze.

g. Packing: Asbestos free.

h. Handwheel: Malleable iron, bronze, or aluminum.

B. Bronze Gate Valves, RS, Class 125:

1. Description:

a. Standard: MSS SP-80, Type 2.

b. CWP Rating: 200 psig.

c. Body Material: Bronze with integral seat and screw-in bonnet.

d. Ends: Threaded or solder joint.

e. Stem: Bronze.

f. Disc: Solid wedge; bronze.

g. Packing: Asbestos free.

h. Handwheel: Malleable iron, bronze, or aluminum.

C. Bronze Gate Valves, NRS, Class 150:

1. Description:

a. Standard: MSS SP-80, Type 1.

b. CWP Rating: 300 psig.

c. Body Material: Bronze with integral seat and union-ring bonnet.

d. Ends: Threaded.

e. Stem: Bronze.

f. Disc: Solid wedge; bronze.

g. Packing: Asbestos free.

h. Handwheel: Malleable iron, bronze, or aluminum.

D. Bronze Gate Valves, RS, Class 150:

1. Description:

a. Standard: MSS SP-80, Type 2.

b. CWP Rating: 300 psig.

c. Body Material: Bronze with integral seat and union-ring bonnet.

d. Ends: Threaded.

e. Stem: Bronze.

f. Disc: Solid wedge; bronze.

g. Packing: Asbestos free.

h. Handwheel: Malleable iron, bronze, or aluminum.

E. Bronze Gate Valves, Press Ends:

1. Description:

a. Standard: MSS SP-80 and MSS SP-139.

b. CWP Rating: Minimum 200 psig.

c. Body Material: Bronze with integral seat and union-ring bonnet.

d. Ends: Press.

e. Press Ends Connection Rating: Minimum 200 psig.

f. Stem: Brass or bronze rising.

g. Disc: Solid wedge; bronze.

h. Packing: Graphite.

i. Port: Full.

j. Handwheel: Malleable iron, bronze, or aluminum.

2.3 IRON GATE VALVES

A. Iron Gate Valves, NRS, Class 150:

1. Description:

a. Standard: MSS SP-70, Type I.

b. CWP Rating: 200 psig.

c. Body Material: Gray iron with bolted bonnet.

d. Ends: Flanged.

e. Trim: Bronze.

f. Disc: Solid wedge.

g. Packing and Gasket: Asbestos free.

B. Iron Gate Valves, OS&Y, Class 125:

1. Description:

a. Standard: MSS SP-70, Type I.

b. CWP Rating: 200 psig.

c. Body Material: Gray iron with bolted bonnet.

d. Ends: Flanged.

e. Trim: Bronze.

f. Disc: Solid wedge.

g. Packing and Gasket: Asbestos free.

C. Iron Gate Valves, NRS, Class 250:

1. Description:

a. Standard: MSS SP-70, Type I.

b. CWP Rating: 500 psig.

c. Body Material: Gray iron with bolted bonnet.

d. Ends: Flanged.

e. Trim: Bronze.

f. Disc: Solid wedge.

g. Packing and Gasket: Asbestos free.

D. Iron Gate Valves, OS&Y, Class 250:

1. Description:

a. Standard: MSS SP-70, Type I.

b. CWP Rating: 500 psig.
c. Body Material: Gray iron with bolted bonnet.
d. Ends: Flanged.
e. Trim: Bronze.
f. Disc: Solid wedge.
g. Packing and Gasket: Asbestos free.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install chainwheels on operators for gate valves NPS 4 and larger and more than 96 inches above floor. Extend chains to 60 inches above finished floor.

F. Install valve tags. Comply with requirements in Section 22 05 53 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. Use gate valves for shutoff service only.

B. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.

C. For Grooved-End Copper Tubing and Steel Piping: Valve ends may be grooved.

3.5 LOW-PRESSURE, COMPRESSED-AIR VALVE SCHEDULE (150 PSIG OR LESS)

A. Pipe NPS 2 and Smaller: Bronze gate valves, NRS, Class 150 with threaded ends.

B. Pipe NPS 2-1/2 and Larger: Iron gate valves, NRS, Class 150 with flanged ends.

3.6 HIGH-PRESSURE, COMPRESSED-AIR VALVE SCHEDULE (150 TO 200 PSIG

A. Pipe NPS 2 and Smaller: Bronze gate valves NRS, Class 150 with threaded ends.

B. Pipe NPS 2-1/2 and Larger: Iron gate valves, NRS, Class 250 with flanged ends.

3.7 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Bronze gate valves, NRS, Class 150 with threaded ends.
2. Bronze gate valves, press ends.

B. Pipe NPS 2-1/2 and Larger: Iron gate valves, NRS , Class 125 with flanged ends.

END OF SECTION

SECTION 22 05 29 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Fiberglass pipe hangers.
4. Metal framing systems.
5. Fiberglass strut systems.
6. Thermal hanger-shield inserts.
7. Fastener systems.
8. Pipe stands.
9. Pipe-positioning systems.
10. Equipment supports.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:

1. Trapeze pipe hangers.
2. Metal framing systems.
3. Fiberglass strut systems.
4. Pipe stands.
5. Equipment supports.

C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of trapeze hangers.
2. Include design calculations for designing trapeze hangers.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.5 QUALITY ASSURANCE

A. Structural-Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M.

B. Pipe Welding Qualifications: Qualify procedures and operators according to 2015 ASME Boiler and Pressure Vessel Code, Section IX.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized, hot-dip galvanized, or electro-galvanized.
3. Nonmetallic Coatings: Plastic coated or epoxy powder coated.

4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Copper Pipe and Tube Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly, made from structural-carbon-steel shapes, with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Description: Shop- or field-fabricated pipe-support assembly, made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
2. Standard: Comply with MFMA-4, factory-fabricated components for field assembly.
3. Channels: Continuous slotted carbon-steel channel with inturned lips.
4. Channel Width: Selected for applicable load criteria.
5. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Non-MFMA Manufacturer Metal Framing Systems:

1. Description: Shop- or field-fabricated pipe-support assembly, made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
2. Standard: Comply with MFMA-4, factory-fabricated components for field assembly.
3. Channels: Continuous slotted carbon-steel channel with inturned lips.
4. Channel Width: Select for applicable load criteria.
5. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

2.4 THERMAL HANGER-SHIELD INSERTS

A. Insulation-Insert Material for Cold Piping: ASTM C552, Type II cellular glass with 100-psig or ASTM C591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.

B. Insulation-Insert Material for Hot Piping: Water-repellent-treated, ASTM C533, Type I calcium silicate with 100-psig ASTM C552, Type II cellular glass with 100-psig or ASTM C591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength.

C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.5 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type anchors, for use in hardened portland cement concrete, with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Indoor Applications: Zinc-coated steel.

2. Outdoor Applications: Stainless steel.

2.6 PIPE STANDS

A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. Compact Pipe Stand:

1. Description: Single base unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.
2. Base: Single, vulcanized rubber, molded polypropylene, or polycarbonate.
3. Hardware: Galvanized steel or polycarbonate.
4. Accessories: Protection pads.

C. Low-Profile, Single-Base, Single-Pipe Stand:

1. Description: Single base with vertical and horizontal members, and pipe support, for roof installation without membrane protection.
2. Base: Single, vulcanized rubber, molded polypropylene, or polycarbonate.
3. Vertical Members: Two galvanized-steel, continuous-thread, 1/2-inch rods.
4. Horizontal Member: Adjustable horizontal, galvanized-steel pipe support channels.
5. Pipe Supports: Strut clamps, Clevis hanger, Swivel hanger.
6. Hardware: Galvanized steel.
7. Accessories: Protection pads.
8. Height: 12 inches above roof.

D. High-Profile, Single-Base, Single-Pipe Stand:

1. Description: Single base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
2. Base: Single vulcanized rubber or molded polypropylene.
3. Vertical Members: Two galvanized-steel, continuous-thread, 1/2-inch rods.
4. Horizontal Member: One adjustable-height, galvanized- or stainless-steel, pipe-support slotted channel or plate.
5. Pipe Supports: Roller , Clevis hanger ,Swivel hanger.
6. Hardware: Galvanized OR Stainless steel.
7. Accessories: Protection pads, 1/2-inch, continuous-thread, galvanized-steel rod, 1/2-inch, continuous-thread, stainless-steel rod.
8. Height: 36 inches above roof.

E. High-Profile, Multiple-Pipe Stand:

1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
2. Bases: Two or more; vulcanized rubber.
3. Vertical Members: Two or more, galvanized or stainless-steel channels.
4. Horizontal Members: One or more, adjustable-height, galvanized or stainless-steel pipe support.
5. Pipe Supports: Roller, Strut clamps, Clevis hanger or Swivel hanger.
6. Hardware: Galvanized or Stainless steel.
7. Accessories: Protection pads, 1/2-inch, continuous-thread rod.
8. Height: 36 inches above roof.

F. Curb-Mounted-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

2.7 PIPE-POSITIONING SYSTEMS

A. Description: IAPMO PS 42 positioning system composed of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.8 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-carbon-steel shapes.

2.9 MATERIALS

A. Aluminum: ASTM B221.

B. Carbon Steel: ASTM A1011/A1011M.

C. Structural Steel: ASTM A36/A36M carbon-steel plates, shapes, and bars; black and galvanized.

D. Stainless Steel: ASTM A240/A240M.

E. Grout: ASTM C1107/C1107M, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.

2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with requirements in Section 07 84 13 "Penetration Firestopping" for firestopping materials and installation, for penetrations through fire-rated walls, ceilings, and assemblies.

B. Strength of Support Assemblies: Where not indicated, select sizes of components, so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

3.2 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size, or install intermediate supports for smaller-diameter pipes as specified for individual pipe hangers.

2. Field fabricate from ASTM A36/A36M carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Fiberglass Pipe-Hanger Installation: Comply with applicable portions of MSS SP-58. Install hangers and attachments as required to properly support piping from building structure.

D. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

E. Thermal Hanger-Shield Installation: Install in pipe hanger or shield for insulated piping.

F. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete, after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.

2. Install mechanical-expansion anchors in concrete, after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

G. Pipe Stand Installation:

1. Pipe Stand Types, except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.

2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Section 07 72 00 "Roof Accessories" for curbs.

H. Pipe-Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.

I. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

J. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

K. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

L. Install lateral bracing with pipe hangers and supports to prevent swaying.

M. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms, and install reinforcing bars through openings at top of inserts.

N. Load Distribution: Install hangers and supports, so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

O. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

P. Insulated Piping:

1. Attach clamps and spacers to piping.
    a. Piping Operating Above Ambient Air Temperature: Clamp may project through insulation.
    b. Piping Operating Below Ambient Air Temperature: Use thermal hanger-shield insert with clamp sized to match OD of insert.
    c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
2. Install MSS SP-58, Type 39 protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
    a. Option: Thermal hanger-shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
3. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
    a. Option: Thermal hanger-shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
4. Shield Dimensions for Pipe: Not less than the following:
    a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
    b. NPS 4: 12 inches long and 0.06 inch thick.
    c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
    d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
    e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal Hanger Shields: Install with insulation of same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment, and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections, so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.6 PAINTING

A. Touchup: Clean field welds and abraded, shop-painted areas. Paint exposed areas immediately after erecting hangers and supports. Use same materials as those used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas, and apply galvanizing-repair paint to comply with ASTM A780/A780M.

3.7 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finishes.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports, metal trapeze pipe hangers and metal framing systems and attachments for general service applications.

F. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.

G. Use padded hangers for piping that is subject to scratching.

H. Use thermal hanger-shield inserts for insulated piping and tubing.

I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.

5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction occurs.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction occurs.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction occurs but vertical adjustment is unnecessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction occurs and vertical adjustment is unnecessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation, in addition to expansion and contraction, is required.

J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment of up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11 split pipe rings.

4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable-Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.
13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal Hanger-Shield Inserts: For supporting insulated pipe.

N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.

5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load, and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load, and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load, and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
    a. Horizontal (MSS Type 54): Mounted horizontally.
    b. Vertical (MSS Type 55): Mounted vertically.
    c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

O. Comply with MSS SP-58 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

P. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

Q. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

R. Use pipe-positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION

SECTION 22 05 53 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Stencils.
5. Valve tags.
6. Warning tags.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: Brass, 0.032-inch, stainless steel, 0.025-inch aluminum, 0.032-inch or anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Letter Color: White.
3. Background Color: Black.
4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
5. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
6. Fasteners: Stainless-steel rivets or self-tapping screws.
7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: Black.
3. Background Color: White.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: Red.

C. Background Color: Red.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information plus emergency notification instructions.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: Size letters according to ASME A13.1 for piping At least 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.

2.4 STENCILS

A. Stencils for Piping:

1. Lettering Size: Size letters according to ASME A13.1 for piping At least 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.
2. Stencil Material: Brass.
3. Stencil Paint: Exterior, gloss, alkyd enamel in colors complying with recommendations in ASME A13.1 unless otherwise indicated. Paint may be in pressurized spray-can form.

4. Identification Paint: Exterior, alkyd enamel in colors according to ASME A13.1 unless otherwise indicated. Paint may be in pressurized spray-can form.

2.5 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.

1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.

2. Fasteners: Brass wire-link chain or beaded chain or S-hook.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

2.6 WARNING TAGS

A. Description: Preprinted or partially preprinted accident-prevention tags of plasticized card stock with matte finish suitable for writing.

1. Size: 3 by 5-1/4 inches minimum.

2. Fasteners: Brass grommet and wire.

3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."

4. Color: Safety yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

3.3 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.4 PIPE LABEL INSTALLATION

A. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, with painted, color-coded bands or rectangles on each piping system.

1. Identification Paint: Use for contrasting background.

2. Stencil Paint: Use for pipe marking.

B. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.

2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.

3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.

4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

C. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.

D. Pipe Label Color Schedule:

1. Low-Pressure Compressed Air Piping:
   a. Background: Safety blue.
   b. Letter Colors: White.
2. High-Pressure Compressed Air Piping:
   a. Background: Safety blue.
   b. Letter Colors: White.
3. Domestic Water Piping
   a. Background: Safety green.
   b. Letter Colors: White.
4. Sanitary Waste and Storm Drainage Piping:
   a. Background Color: Safety black.
   b. Letter Color: White.

3.5 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, shutoff valves, faucets, convenience and lawn-watering hose connections, and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Size and Shape:
   a. Cold Water: 1-1/2 inches, round.
   b. Hot Water: 1-1/2 inches, round.
   c. Low-Pressure Compressed Air: 1-1/2 inches, round.
   d. High-Pressure Compressed Air: 1-1/2 inches, round.
2. Valve-Tag Colors:
   a. Cold Water: Natural.
   b. Hot Water: Natural.
   c. Low-Pressure Compressed Air: Natural.
   d. High-Pressure Compressed Air: Natural.
3. Letter Colors:
   a. Cold Water: White.
   b. Hot Water: White.
   c. Low-Pressure Compressed Air: White.
   d. High-Pressure Compressed Air: White.

3.6 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION

SECTION 22 07 19 - PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes insulating the following plumbing piping services:

1. Domestic cold-water piping.
2. Domestic hot-water piping.
3. Domestic recirculating hot-water piping.
4. Domestic chilled-water piping for drinking fountains.
5. Sanitary waste piping exposed to freezing conditions.
6. Storm-water piping exposed to freezing conditions.
7. Roof drains and rainwater leaders.
8. Supplies and drains for handicap-accessible lavatories and sinks.

B. Related Sections:

1. Section 22 07 16 "Plumbing Equipment Insulation" for equipment insulation.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).

B. Sustainable Design Submittals.

C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail attachment and covering of heat tracing inside insulation.
3. Detail insulation application at pipe expansion joints for each type of insulation.
4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
5. Detail removable insulation at piping specialties, equipment connections, and access panels.
6. Detail application of field-applied jackets.
7. Detail application at linkages of control devices.

D. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use. Sample sizes are as follows:

1. Preformed Pipe Insulation Materials: 12 inches long by NPS 2.
2. Jacket Materials for Pipe: 12 inches long by NPS 2.
3. Sheet Jacket Materials: 12 inches square.
4. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

C. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products in accordance with ASTM E84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less and smoke-developed index of 50 or less.

2. Insulation Installed Outdoors: Flame-spread index of 75 or less and smoke-developed index of 150 or less.

C. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.8 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come into contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested in accordance with ASTM C871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable in accordance with ASTM C795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Comply with ASTM C552.

1. Preformed Pipe Insulation: Type II, Class 1, without jacket.

2. Preformed Pipe Insulation: Type II, Class 2, with factory-applied ASJ jacket.

3. Factory fabricate shapes in accordance with ASTM C450 and ASTM C585.

4. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

G. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C534/C534M, Type I for tubular materials.

H. Mineral-Fiber, Preformed Pipe: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C547.

1. Preformed Pipe Insulation: Type I, Grade A, without factory-applied jacket with factory-applied ASJ.
2. 850 deg F.
3. Factory fabricate shapes in accordance with ASTM C450 and ASTM C585.
4. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 INSULATING CEMENTS

A. Mineral-Fiber Insulating Cement: Comply with ASTM C195.

B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C196.

C. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C449.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F.

C. Flexible Elastomeric and Polyolefin Adhesive: Solvent-based adhesive.

1. Flame-spread index shall be 25 or less and smoke-developed index shall be 50 or less as tested in accordance with ASTM E84.
2. Wet Flash Point: Below 0 deg F.
3. Service Temperature Range: 40 to 200 deg F.
4. Color: Black.

D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

E. Phenolic Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F.

F. ASJ Adhesive and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A, for bonding insulation jacket lap seams and joints.

G. PVC Jacket Adhesive: Compatible with PVC jacket.

2.4 MASTICS AND COATINGS

A. Materials shall be compatible with insulation materials, jackets, and substrates.

B. Vapor-Retarder Mastic, Water Based: Suitable for indoor use on below-ambient services.

1. Water-Vapor Permeance: Comply with ASTM E96/E96M or ASTM F1249.
2. Service Temperature Range: 0 to plus 180 deg F.
3. Comply with MIL-PRF-19565C, Type II, for permeance requirements, with supplier listing on DOD QPD - Qualified Products Database.
4. Color: White.

C. Vapor-Retarder Mastic, Solvent Based, Indoor Use: Suitable for indoor use on below-ambient services.

1. Water-Vapor Permeance: Comply with ASTM E96/E96M or ASTM F1249.
2. Service Temperature Range: 0 to 180 deg F.
3. Color: White.

D. Vapor-Retarder Mastic, Solvent Based, Outdoor Use: Suitable for outdoor use on below-ambient services.

1. Water-Vapor Permeance: Comply with ASTM E96/E96M or ASTM F1249.
2. Service Temperature Range: Minus 50 to plus 220 deg F.

3. Color: White.

E. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.

1. Water-Vapor Permeance: ASTM E96/E96M, greater than 1.0 perm at manufacturer's recommended dry film thickness.
2. Service Temperature Range: 0 to plus 180 deg F.
3. Color: White.

2.5 LAGGING ADHESIVES

A. Adhesives shall comply with MIL-A-3316C, Class I, Grade A, and shall be compatible with insulation materials, jackets, and substrates.

1. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
2. Service Temperature Range: 20 to plus 180 deg F.
3. Color: White.

2.6 SEALANTS

A. Materials shall be as recommended by the insulation manufacturer and shall be compatible with insulation materials, jackets, and substrates.

B. Joint Sealants:

1. Permanently flexible, elastomeric sealant.
2. Service Temperature Range: Minus 58 to plus 176 deg F.
3. Color: White or gray.

C. FSK and Metal Jacket Flashing Sealants:

1. Fire- and water-resistant, flexible, elastomeric sealant.
2. Service Temperature Range: Minus 40 to plus 250 deg F.
3. Color: Aluminum.

D. ASJ Flashing Sealants and PVC Jacket Flashing Sealants:

1. Fire- and water-resistant, flexible, elastomeric sealant.
2. Service Temperature Range: Minus 40 to plus 250 deg F.
3. Color: White.

2.7 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C1136, Type II.

2.8 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Glass-Fiber Fabric: Approximately 2 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in. for covering pipe and pipe fittings.

B. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in., in a Leno weave, for pipe.

2.9 FIELD-APPLIED CLOTHS

A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd..

2.10 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C1136, Type I, unless otherwise indicated.

B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Adhesive: As recommended by jacket material manufacturer.

2. Color: Color-code jackets based on system. Color as selected by Architect.

3. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

D. Metal Jacket:

1. Aluminum Jacket: Comply with ASTM B209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.

a. Factory cut and rolled to size.

b. Finish and thickness are indicated in field-applied jacket schedules.

c. Moisture Barrier for Indoor Applications: 1-mil-thick, heat-bonded polyethylene and kraft paper.

d. Moisture Barrier for Outdoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.

e. Factory-Fabricated Fitting Covers:

1) Same material, finish, and thickness as jacket.

2) Preformed two-piece or gore, 45- and 90-degree, short- and long-radius elbows.

3) Tee covers.

4) Flange and union covers.

5) End caps.

6) Beveled collars.

7) Valve covers.

8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2. Stainless-Steel Jacket: ASTM A240/A240M.

a. Factory cut and rolled to size.

b. Material, finish, and thickness are indicated in field-applied jacket schedules.

c. Moisture Barrier for Indoor Applications: 1-mil-thick, heat-bonded polyethylene and kraft paper.

d. Moisture Barrier for Outdoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.

e. Factory-Fabricated Fitting Covers:

1) Same material, finish, and thickness as jacket.

2) Preformed two-piece or gore, 45- and 90-degree, short- and long-radius elbows.

3) Tee covers.

4) Flange and union covers.

5) End caps.

6) Beveled collars.

7) Valve covers.

8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

E. Underground Direct-Buried Jacket: 125-mil-thick vapor barrier and waterproofing membrane, consisting of a rubberized bituminous resin reinforced with a woven-glass fiber or polyester scrim and laminated aluminum foil.

F. Self-Adhesive Outdoor Jacket: 60-mil-thick, laminated vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; consisting of a rubberized bituminous resin on a cross-laminated polyethylene film covered with white aluminum-foil facing.

2.11 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C1136.

1. Width: 3 inches.
2. Thickness: 11.5 mils.
3. Adhesion: 90 ounces force/inch in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch in width.
6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C1136.

1. Width: 3 inches.
2. Thickness: 6.5 mils.
3. Adhesion: 90 ounces force/inch in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch in width.
6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

1. Width: 2 inches.
2. Thickness: 6 mils.
3. Adhesion: 64 ounces force/inch in width.
4. Elongation: 500 percent.
5. Tensile Strength: 18 lbf/inch in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Width: 2 inches.
2. Thickness: 3.7 mils.
3. Adhesion: 100 ounces force/inch in width.
4. Elongation: 5 percent.
5. Tensile Strength: 34 lbf/inch in width.

2.12 SECUREMENTS

A. Bands:

1. Stainless Steel: ASTM A240/A240M, Type 304 or Type 316; 0.015 inch thick, 1/2 inch wide with wing seal or closed seal.
2. Aluminum: ASTM B209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal or closed seal.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.

C. Wire: 0.080-inch nickel-copper alloy.

2.13 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers,:

1. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

B. Protective Shielding Piping Enclosures,:

1. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.

2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:

1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range of between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

2. Carbon Steel: Coat carbon steel operating at a service temperature of between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

C. Coordinate insulation installation with the tradesman installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and of thicknesses required for each item of pipe system, as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during storage, application, and finishing. Replace insulation materials that get wet.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.

2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends attached to structure with vapor-barrier mastic.
3. Install insert materials and insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:
1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward-clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward-clinching staples along edge at 4 inches o.c.
a. For below-ambient services, apply vapor-barrier mastic over staples.
4. Cover joints and seams with tape, in accordance with insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 25 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches in similar fashion to butt joints.

P. For above-ambient services, do not install insulation to the following:
1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Section 07 84 13 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 07 84 13 "Penetration Firestopping."

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials, except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, Mechanical Couplings, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, mechanical couplings, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as that of adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as that used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as that used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers, so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges, mechanical couplings, and unions, using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Stencil or label the outside insulation jacket of each union with the word "union" matching size and color of pipe labels.

7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.

8. For services not specified to receive a field-applied jacket, except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing, using PVC tape.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as that of adjoining pipe insulation.

2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union at least 2 times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless steel or aluminum bands. Select band material compatible with insulation and jacket.

3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.

4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.

5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 INSTALLATION OF CELLULAR-GLASS INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands, and tighten bands without deforming insulation materials.

2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.

3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward-clinched staples at 6 inches o.c.

4. For insulation with factory-applied jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.

2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.

3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as that of pipe insulation.

4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as that of straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.7 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as that of pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as that of pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.8 INSTALLATION OF MINERAL-FIBER INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands, and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.

3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as that of straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as that of straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.9 INSTALLATION OF PHENOLIC INSULATION

A. General Installation Requirements:

1. Secure single-layer insulation with stainless steel bands at 12-inch intervals, and tighten bands without deforming insulation materials.
2. Install two-layer insulation with joints tightly butted and staggered at least 3 inches. Secure inner layer with 0.062-inch wire spaced at 12-inch intervals. Secure outer layer with stainless steel bands at 12-inch intervals.

B. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands, and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward-clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets with vapor retarders on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic and flashing sealant.

C. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of block insulation of same material and thickness as that of pipe insulation.

D. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed insulation sections of same material as that of straight segments of pipe insulation. Secure according to manufacturer's written instructions.

E. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed insulation sections of same material as that of straight segments of pipe insulation. Secure according to manufacturer's written instructions.

2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.10 INSTALLATION OF POLYOLEFIN INSULATION

A. Insulation Installation on Straight Pipes and Tubes:
1. Seal split-tube longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:
1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of polyolefin sheet insulation of same thickness as that of pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:
1. Install mitered sections of polyolefin pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:
1. Install cut sections of polyolefin pipe and sheet insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.11 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.
1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch-thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:
1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch-wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.
1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof

sealant recommended by insulation manufacturer. Secure jacket with stainless steel bands 12 inches o.c. and at end joints.

3.12 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting."

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless steel jackets.

3.13 FIELD QUALITY CONTROL

A. Owner will engage a qualified testing agency to perform tests and inspections.

B. Engage a qualified testing agency to perform tests and inspections.

C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

D. Perform tests and inspections.

E. Tests and Inspections: Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

F. All insulation applications will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports.

3.14 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.

2. Underground piping.

3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.15 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water:

1. NPS 1 and Smaller: Insulation shall be one of the following:

a. Flexible Elastomeric: 3/4 inch thick.

2. NPS 1-1/4 and Larger: Insulation shall be one of the following:

a. Flexible Elastomeric: 1 inch thick.

b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

B. Domestic Hot and Recirculated Hot Water:

1. NPS 1-1/4 and Smaller: Insulation shall be the following:

a. Flexible Elastomeric: 3/4 inch thick.

b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

2. NPS 1-1/2 and Larger: Insulation shall be one of the following:
   a. Flexible Elastomeric: 1 inch thick.
   b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

C. Stormwater and Overflow:
1. All Pipe Sizes: Insulation shall be one of the following:
   a. Flexible Elastomeric: 1 inch thick.
   b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

D. Roof Drain and Overflow Drain Bodies:
1. All Pipe Sizes: Insulation shall be one of the following:
   a. Flexible Elastomeric: 1 inch thick.
   b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

E. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:
1. All Pipe Sizes: Insulation shall be one of the following:
   a. Flexible Elastomeric: 1/2 inch thick.
   b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.

F. Floor Drains, Traps, and Sanitary Drain Piping within 10 Feet of Drain Receiving Condensate and Equipment Drain Water below 60 Deg F:
1. All Pipe Sizes: Insulation shall be one of the following:
   a. Flexible Elastomeric: 3/4 inch thick.
   b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.

G. Hot Service Drains:
1. All Pipe Sizes: Insulation shall be one of the following:
   a. Cellular Glass: 1-1/2 inches thick.
   b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

H. Hot Service Vents:
1. All Pipe Sizes: Insulation shall be one of the following:
   a. Cellular Glass: 1-1/2 inches thick.
   b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

3.16 OUTDOOR, UNDERGROUND PIPING INSULATION SCHEDULE

A. Sanitary Waste Piping, All Sizes, Where Heat Tracing Is Installed: Cellular glass, 2 inches thick.

B. Chilled Water, All Sizes: Cellular glass, 2 inches thick.

3.17 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:
1. PVC: 20 mils thick.
2. Aluminum, Smooth: 0.020 inch thick.
3. Painted Aluminum, Smooth: 0.020 inch thick.
4. Stainless Steel, Type 304 or Type 316, Smooth No. 2B Finish: 0.020 inch thick.

D. Piping, Exposed:
1. PVC: 20 mils thick.
2. Aluminum, Smooth: 0.020 inch thick.
3. Painted Aluminum, Smooth: 0.020 inch thick.

4. Stainless Steel, Type 304 or Type 316, Smooth No. 2B Finish: 0.016 inch thick.

3.18 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:

1. PVC: 20 mils thick.
2. Aluminum, Smooth: 0.020 inch thick.
3. Painted Aluminum, Smooth: 0.020 inch thick.
4. Stainless Steel, Type 304 or Type 316, Smooth No. 2B Finish: 0.016 inch thick.

D. Piping, Exposed:

1. PVC: 30 mils thick.
2. Painted Aluminum, Smooth with Z-Shaped Locking Seam: 0.020 inch thick.
3. Stainless Steel, Type 304 or Type 316, Smooth No. 2B Finish with Z-Shaped Locking Seam: 0.016 inch thick.

3.19 UNDERGROUND, FIELD-APPLIED INSULATION JACKET

A. For underground direct-buried piping applications, install underground direct-buried jacket over insulation material.

END OF SECTION

SECTION 22 11 16 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Copper tube and fittings.
2. Ductile-iron pipe and fittings.
3. Galvanized-steel pipe and fittings.
4. Stainless steel piping and fittings.
5. CPVC piping.
6. PEX tube and fittings.
7. PEX-AL-PEX tube and fittings.
8. PEX-AL-HDPE tube and fittings.
9. PVC pipe and fittings.
10. PP-R pipe and fittings.
11. Piping joining materials.
12. Encasement for piping.
13. Transition fittings.
14. Dielectric fittings.

B. Related Requirements:
1. Section 22 11 13 "Facility Water Distribution Piping" for water-service piping and water meters outside the building from source to the point where water-service piping enters the building.

1.3 ACTION SUBMITTALS

A. Product Data:
1. Pipe and tube.
2. Fittings.
3. Joining materials.
4. Transition fittings.

B. Sustainable Design Submittals:
1. Product Data: For adhesives, indicating VOC content.
2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
3. Environmental Product Declaration: For each product.
4. Health Product Declaration: For each product.
5. Sourcing of Raw Materials: Corporate sustainability report for each manufacturer.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Piping layout, or BIM model, drawn to scale, showing the items described in this Section, and coordinated with all building trades.

B. System purging and disinfecting activities report.

C. Field quality-control reports.

1.5 FIELD CONDITIONS

A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:
1. Notify Architect no fewer than two days in advance of proposed interruption of water service.

2. Do not interrupt water service without Architect's written permission.

1.6 WARRANTY

A. Polypropylene Piping (PP-R) Manufacturer's Warranty: Manufacturer agrees to repair or replace PP-R pipe and fittings that fail in materials or workmanship within 10 years from date of Substantial Completion.

1. Warranty is to cover labor and material costs of repairing and/or replacing defective materials and repairing any incidental damage caused by failure of the piping system due to defects in materials or manufacturing.

2. Warranty is to be in effect only upon submission by the Contractor to the manufacturer of valid pressure/leak documentation indicating that the system was tested and passed the manufacturer's pressure/leak test.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Potable-water piping and components shall comply with NSF 14, NSF 61, and NSF 372.

2.2 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tube: ASTM B88, Type K.

B. Annealed-Temper Copper Tube: ASTM B88, Type K and ASTM B88, Type M.

C. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.

D. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, pressure fittings.

E. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.

F. Cast Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.

G. Wrought Copper Unions: ASME B16.22.

H. Copper-Tube, Mechanically Formed Tee Fitting: For forming T-branch on copper water tube.

1. Description: Tee formed in copper tube in accordance with ASTM F2014.

I. Grooved, Mechanical-Joint, Copper Tube Appurtenances:

1. Grooved-End, Copper Fittings: ASTM B75 copper tube or ASTM B584 bronze castings.

2. Grooved-End-Tube Couplings: To fit copper-tube dimensions; rigid pattern unless otherwise indicated; gasketed fitting, EPDM-rubber gasket, UL classified per NSF 61 and NSF 372, and rated for minimum 180 deg F, for use with ferrous housing and steel bolts and nuts; 300 psigminimum CWP pressure rating.

J. Copper Tube, Pressure-Seal-Joint Fittings:

1. Fittings: Cast-brass, cast-bronze, or wrought-copper with EPDM O-ring seal in each end.

2. Minimum 200-psig working-pressure rating at 250 deg F.

K. Copper-Tube, Push-on-Joint Fittings:

1. Description:

a. Cast-copper fitting complying with ASME B16.18 or wrought-copper fitting complying with ASME B 16.22.

b. Stainless steel teeth and EPDM-rubber, O-ring seal in each end instead of solder-joint ends.

2.3 DUCTILE-IRON PIPE AND FITTINGS

A. Mechanical-Joint, Ductile-Iron Pipe:

1. AWWA C151/A21.51, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.

2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

B. Standard-Pattern, Mechanical-Joint Fittings:

1. AWWA C110/A21.10, ductile or gray iron.

2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

C. Compact-Pattern, Mechanical-Joint Fittings:

1. AWWA C153/A21.53, ductile iron.
2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

D. Push-on-Joint, Ductile-Iron Pipe:

1. AWWA C151/A21.51.
2. Push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.

E. Standard-Pattern, Push-on-Joint Fittings:

1. AWWA C110/A21.10, ductile or gray iron.
2. Gaskets: AWWA C111/A21.11, rubber.

F. Compact-Pattern, Push-on-Joint Fittings:

1. AWWA C153/A21.53, ductile iron.
2. Gaskets: AWWA C111/A21.11, rubber.

G. Plain-End, Ductile-Iron Pipe: AWWA C151/A21.51.

H. Appurtenances for Grooved-End, Ductile-Iron Pipe:

1. Fittings for Grooved-End, Ductile-Iron Pipe: ASTM A47/A47M, malleable-iron castings or ASTM A536, ductile-iron castings with dimensions that match pipe.
2. Mechanical Couplings for Grooved-End, Ductile-Iron-Piping:
   a. AWWA C606 for ductile-iron-pipe dimensions.
   b. Ferrous housing sections.
   c. EPDM-rubber gaskets suitable for hot and cold water.
   d. Bolts and nuts.
   e. Minimum Pressure Rating:
      1) NPS 14 to NPS 18: 250 psig.
      2) NPS 20 to NPS 46: 150 psig.

2.4 GALVANIZED-STEEL PIPE AND FITTINGS

A. Galvanized-Steel Pipe:

1. ASTM A53/A53M, Type E,, Standard Weight.
2. Include ends matching joining method.

B. Galvanized-Steel Pipe Nipples: ASTM A733, made of ASTM A53/A53M or ASTM A106/A106M, Standard Weight, seamless steel pipe with threaded ends.

C. Galvanized, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.

D. Malleable-Iron Unions:

1. ASME B16.39, Class 150.
2. Hexagonal-stock body.
3. Ball-and-socket, metal-to-metal, bronze seating surface.
4. Threaded ends.

E. Flanges: ASME B16.1, Class 125, cast iron.

F. Appurtenances for Grooved-End, Galvanized-Steel Pipe:

1. ASTM Fittings for Grooved-End, Galvanized-Steel Pipe: Galvanized, ASTM A47/A47M, malleable-iron casting; ASTM A106/A106M, steel pipe; or ASTM A536, ductile-iron casting; with dimensions matching steel pipe.
2. AWWA Fittings for Grooved-End, Galvanized-Steel Pipe:
   a. AWWA C606 for steel-pipe dimensions.

b. Ferrous housing sections.

c. EPDM-rubber gaskets suitable for hot and cold water.

d. Bolts and nuts.

e. Minimum Pressure Rating:

1) NPS 8 and Smaller: 600 psig.

2.5 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials:

1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.

2. Full-face or ring type unless otherwise indicated.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Solder Filler Metals: ASTM B32, lead-free alloys.

D. Flux: ASTM B813, water flushable.

E. Brazing Filler Metals: AWS A5.8M/A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

F. Solvent Cements for Joining CPVC Piping and Tubing: ASTM F493.

1. Verify solvent cement has a VOC content of 490 g/L or less.

2. Verify adhesive complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

G. Solvent Cements for Joining PVC Piping: ASTM D2564. Include primer according to ASTM F656.

1. Verify solvent cement has a VOC content of 510 g/L or less.

2. <Double click to insert sustainable design text for adhesive primer.>

3. Verify adhesive complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

4. Verify adhesive primer complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

H. Plastic, Pipe-Flange Gaskets, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

2.6 ENCASEMENT FOR PIPING

A. Standard: ASTM A674 or AWWA C105/A21.5.

B. Form: Sheet or tube.

C. Color: Black or natural.

2.7 TRANSITION FITTINGS

A. General Requirements:

1. Same size as pipes to be joined.

2. Pressure rating at least equal to pipes to be joined.

3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

C. Sleeve-Type Transition Coupling: AWWA C219.

D. Plastic-to-Metal Transition Fittings:

1. Description:
    a. CPVC or PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions.
    b. One end with threaded brass insert and one solvent-cement-socket or threaded end.

E. Plastic-to-Metal Transition Unions:
1. Description:
    a. CPVC or PVC four-part union.
    b. Brass or stainless steel threaded end.
    c. Solvent-cement-joint or threaded plastic end.
    d. Rubber O-ring.
    e. Union nut.

2.8 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:
1. Standard: ASSE 1079.
2. Pressure Rating: 150 psig.
3. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:
1. Standard: ASSE 1079.
2. Factory-fabricated, bolted, companion-flange assembly.
3. Pressure Rating: 150 psig.
4. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Insulating Kits:
1. Nonconducting materials for field assembly of companion flanges.
2. Pressure Rating: 150 psig.
3. Gasket: Neoprene or phenolic.
4. Bolt Sleeves: Phenolic or polyethylene.
5. Washers: Phenolic with steel backing washers.

E. Dielectric Nipples:
1. Standard: IAPMO PS 66.
2. Electroplated steel nipple complying with ASTM F1545.
3. Pressure Rating and Temperature: 300 psig at 225 deg F.
4. End Connections: Male threaded or grooved.
5. Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.

D. Under-building-slab, domestic water, building-service piping, NPS 3 and smaller, shall be one of the following:

1. Annealed-temper copper tube, ASTM B88, Type K; joints.

E. Under-building-slab, domestic water, building-service piping, NPS 4 to NPS 8 and larger, shall be one of the following:

1. Annealed-temper copper tube, ASTM B88, Type K; wrought-copper, solder-joint fittings; and brazed joints.
2. Plain-end, ductile-iron pipe; grooved-joint, ductile-iron-pipe appurtenances; and grooved joints.

F. Under-building-slab, combined domestic water, building-service, and fire-service-main piping, NPS 6 to NPS 12, shall be one of the following:

1. Plain-end, ductile-iron pipe; grooved-joint, ductile-iron-pipe appurtenances; and grooved joints.

G. Under-building-slab, domestic water piping, NPS 2 and smaller, shall be one of the following:

1. Drawn-temper or annealed-temper copper tube, ASTM B88, Type L; wrought-copper, solder-joint fittings; and brazed copper pressure-seal-joint fittings; and pressure-sealed joints.

H. Aboveground domestic water piping, NPS 2 and smaller, shall be one of the following:

1. Galvanized-steel pipe and nipples; galvanized, gray-iron threaded fittings; and threaded joints.
2. Drawn-temper copper tube, ASTM B88, Type L; cast- or wrought-copper, solder-joint fittings; and brazed or soldered joints.
3. Drawn-temper copper tube, ASTM B88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.
4. Drawn-temper copper tube, ASTM B88, Type L; copper push-on-joint fittings; and push-on joints.

I. Aboveground domestic water piping, NPS 2-1/2 to NPS 4, shall be one of the following:

1. Drawn-temper copper tube, ASTM B88, Type L; cast- or wrought-copper, solder-joint fittings; and brazed or soldered joints.
2. Drawn-temper copper tube, ASTM B88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.
3. Drawn-temper copper tube, ASTM B88, Type L; grooved-joint, copper-tube appurtenances; and grooved joints.
4. Galvanized-steel pipe and nipples; galvanized, gray-iron threaded fittings; and threaded joints.
5. Galvanized-steel pipe; grooved-joint, galvanized-steel-pipe appurtenances; and grooved joints.

J. Aboveground, combined domestic water-service and fire-service-main piping, NPS 6 to NPS 12, shall be one of the following:

1. Plain-end, ductile-iron pipe; grooved-joint, ductile-iron-pipe appurtenances; and grooved joints.
2. Galvanized-steel pipe and nipples; galvanized, gray-iron threaded fittings; and threaded joints.
3. Galvanized-steel pipe; grooved-joint, galvanized-steel-pipe appurtenances; and grooved joints.

3.2 EARTHWORK

A. Comply with requirements in Section 31 20 00 "Earth Moving" for excavating, trenching, and backfilling.

3.3 INSTALLATION OF PIPING

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."

C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.

D. Install underground copper tube and ductile-iron pipe in PE encasement according to ASTM A674 or AWWA C105/A21.5.

E. Install valves according to the following:

1. Section 22 05 23.12 "Ball Valves for Plumbing Piping."
2. Section 22 05 23.13 "Butterfly Valves for Plumbing Piping."
3. Section 22 05 23.14 "Check Valves for Plumbing Piping."
4. Section 22 05 23.15 "Gate Valves for Plumbing Piping."

F. Install domestic water piping level without pitch and plumb.

G. Rough-in domestic water piping for water-meter installation according to utility company's requirements.

H. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices in Section 22 05 48 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

I. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

J. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

K. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

L. Install piping to permit valve servicing.

M. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.

N. Install piping free of sags and bends.

O. Install fittings for changes in direction and branch connections.

P. Install PEX tubing with loop at each change of direction of more than 90 degrees.

Q. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

R. Install pressure gauges on suction and discharge piping for each plumbing pump and packaged booster pump. Comply with requirements for pressure gauges in Section 22 05 19 "Meters and Gages for Plumbing Piping."

S. Install thermostats in hot-water circulation piping. Comply with requirements for thermostats in Section 22 11 23 "Domestic Water Pumps."

T. Install thermometers on inlet and outlet piping from each water heater. Comply with requirements for thermometers in Section 22 05 19 "Meters and Gages for Plumbing Piping."

U. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 22 05 17 "Sleeves and Sleeve Seals for Plumbing Piping."

V. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 22 05 17 "Sleeves and Sleeve Seals for Plumbing Piping."

W. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 22 05 18 "Escutcheons for Plumbing Piping."

3.4 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.

E. Soldered Joints for Copper Tubing: Apply ASTM B813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B828 or CDA's "Copper Tube Handbook."

F. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools and procedure recommended by pressure-seal-fitting manufacturer. Leave insertion marks on pipe after assembly.

G. Push-on Joints for Copper Tubing: Clean end of tube. Measure insertion depth with manufacturer's depth gage. Join copper tube and push-on-joint fittings by inserting tube to measured depth.

H. Extruded-Tee Connections: Form tee in copper tube according to ASTM F2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.

I. Joint Construction for Grooved-End Copper Tubing: Make joints according to AWWA C606. Roll groove ends of tubes. Lubricate and install gasket over ends of tubes or tube and fitting. Install coupling housing sections over gasket with keys seated in tubing grooves. Install and tighten housing bolts.

J. Joint Construction for Grooved-End, Ductile-Iron Piping: Make joints according to AWWA C606. Cut round-bottom grooves in ends of pipe at gasket-seat dimension required for specified (flexible or rigid) joint. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections over gasket with keys seated in piping grooves. Install and tighten housing bolts.

K. Joint Construction for Grooved-End Steel Piping: Make joints according to AWWA C606. Square cut groove ends of pipe as specified. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections over gasket with keys seated in piping grooves. Install and tighten housing bolts.

L. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.

M. Joint Construction for Solvent-Cemented Plastic Piping: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.
2. CPVC Piping: Join according to ASTM D2846/D2846M Appendix.
3. PVC Piping: Join according to ASTM D2855.

N. Joints for PEX Tubing, ASTM: Join according to ASTM F1807 for metal insert and copper crimp ring fittings and ASTM F1960 for cold expansion fittings and reinforcing rings.

O. Joints for PEX Tubing, ASSE: Join according to ASSE 1061 for push-fit fittings.

P. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.5 INSTALLATION OF TRANSITION FITTINGS

A. Install transition couplings at joints of dissimilar piping.

B. Transition Fittings in Underground Domestic Water Piping:

1. Fittings for NPS 1-1/2 and Smaller: Fitting-type coupling.
2. Fittings for NPS 2 and Larger: Sleeve-type coupling.

C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings or unions.

3.6 INSTALLATION OF DIELECTRIC FITTINGS

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric couplings or nipples.

C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flange kits.

D. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

3.7 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements for seismic-restraint devices specified in Section 22 05 48 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for hangers, supports, and anchor devices in Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment."

C. Install hangers for copper, ductile iron, galvanized steel, and stainless steel tubing and piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

D. Support horizontal piping within 12 inches of each fitting.

E. Support vertical runs of copper, ductile iron, galvanized steel, and stainless steel tubing and piping to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.8 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:

1. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
3. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
4. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.9 IDENTIFICATION

A. Identify system components. Comply with requirements for identification materials and installation in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

3.10 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
   a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
   b. Adjust calibrated balancing valves to flows indicated.
5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.

6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.11 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
   1. Piping Inspections:
      a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
      b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
         1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
         2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.
      c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
      d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
   2. Piping Tests:
      a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
      b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
      c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
      d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
      e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
      f. Prepare reports for tests and for corrective action required.
B. Domestic water piping will be considered defective if it does not pass tests and inspections.
C. Prepare test and inspection reports.

3.12 CLEANING

A. Clean and disinfect potable domestic water piping as follows:
   1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
   2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
      a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
      b. Fill and isolate system according to either of the following:
         1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.

2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.

c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.

d. Repeat procedures if biological examination shows contamination.

e. Submit water samples in sterile bottles to authorities having jurisdiction.

B. Clean non-potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.

2. Use purging procedures prescribed by authorities having jurisdiction or; if methods are not prescribed, follow procedures described below:

a. Flush piping system with clean, potable water until dirty water does not appear at outlets.

b. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

C. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.

D. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

END OF SECTION

SECTION 22 11 19 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Vacuum breakers.
2. Backflow preventers.
3. Water pressure-reducing valves.
4. Automatic water shutoff valve systems.
5. Balancing valves.
6. Temperature-actuated, water mixing valves.
7. Strainers for domestic water piping.
8. Outlet boxes.
9. Hose stations.
10. Hose bibbs.
11. Wall hydrants.
12. Ground hydrants.
13. Post hydrants.
14. Roof hydrants.
15. Drain valves.
16. Water-hammer arresters.
17. Trap-seal primer device.
18. Trap-seal primer systems.
19. Flexible connectors.
20. Water meters.

B. Related Requirements:

1. Section 21 11 00 "Facility Fire-Suppression Water-Service Piping" for fire water-service backflow prevention devices.
2. Section 22 05 19 "Meters and Gauges for Plumbing Piping" for thermometers, pressure gauges, and flow meters in domestic water piping.
3. Section 22 11 16 "Domestic Water Piping" for water meters.
4. Section 22 32 00 "Domestic Water Filtration Equipment" for water filters in domestic water piping.
5. Section 22 43 00 "Healthcare Plumbing Fixtures" for thermostatic mixing valves for sitz baths, thermostatic mixing-valve assemblies for hydrotherapy equipment, and outlet boxes for dialysis equipment.
6. Section 22 45 00 "Emergency Plumbing Fixtures" for water tempering equipment.
7. Section 22 47 16 "Pressure Water Coolers" for water filters for water coolers.
8. Section 22 47 23 "Remote Water Coolers" for water filters for water coolers.
9. Section 23 09 23.18 "Leak Detection Instruments" for leak detection devices related to HVAC applications.

1.3 DEFINITIONS

A. AMI: Advanced Metering Infrastructure.

B. AMR: Automatic Meter Reading.

C. FKM: A family of fluroelastomer materials defined by ASTM D1418.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For domestic water piping specialties.

1. Include diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Test and inspection reports.

B. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

A. Domestic water piping specialties intended to convey or dispense water for human consumption are to comply with the SDWA, requirements of authorities having jurisdiction, and NSF 61 and NSF 372, or to be certified in compliance with NSF 61 and NSF 372 by an American National Standards Institute (ANSI)-accredited third-party certification body that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

2.2 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

2.3 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:

1. Standard: ASSE 1001.
2. Size: NPS 1/4 to NPS 3, as required to match connected piping.
3. Body: Bronze.
4. Inlet and Outlet Connections: Threaded.
5. Finish: Rough bronze or Chrome plated.

B. Hose-Connection Vacuum Breakers:

1. Standard: ASSE 1011.
2. Body: Bronze, nonremovable, with manual drain.
3. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
4. Finish: Chrome or nickel plated.

C. Pressure Vacuum Breakers:

1. Standard: ASSE 1020.
2. Operation: Continuous-pressure applications.
3. Pressure Loss: 5 psig maximum, through middle third of flow range.

2.4 BACKFLOW PREVENTERS

A. Intermediate Atmospheric-Vent Backflow Preventers:

1. Standard: ASSE 1012.
2. Operation: Continuous-pressure applications.
3. Size: NPS 1/2.
4. Body: Bronze.
5. End Connections: Union, solder joint.
6. Finish: Rough bronze.

B. Reduced-Pressure-Principle Backflow Preventers:

1. Standard: ASSE 1013.
2. Operation: Continuous-pressure applications.
3. Pressure Loss: 8 psig maximum, through middle third of flow range.
4. Accessories:
   a. Valves NPS 2 and Smaller: Ball type with threaded ends on inlet and outlet.
   b. Valves NPS 2-1/2 and Larger: Outside-screw and yoke-gate type with flanged ends on inlet and outlet.
   c. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

C. Double-Check, Backflow-Prevention Assemblies:
1. Standard: ASSE 1015.
2. Operation: Continuous-pressure applications unless otherwise indicated.
3. Pressure Loss: 5 psig maximum, through middle third of flow range.

D. Dual-Check-Valve Backflow Preventers:
1. Standard: ASSE 1024.
2. Operation: Continuous-pressure applications.

E. Hose-Connection Backflow Preventers:
1. Standard: ASSE 1052.
2. Operation: Up to 10-foot head of water back pressure.
3. Inlet Size: NPS 3/4.
4. Outlet Size: Garden-hose thread complying with ASME B1.20.7.
5. Capacity: At least 3-gpm flow.

F. Backflow-Preventer Test Kits:
1. Description: Factory calibrated, with gauges, fittings, hoses, and carrying case with test-procedure instructions.

2.5 WATER PRESSURE-REDUCING VALVES

A. Water Regulators Insert drawing designation if any:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Apollo Flow Controls; Conbraco Industries, Inc.
   b. Cash Acme, A Division of Reliance Worldwide Corporation.
   c. WATTS.
   d. Zurn Industries, LLC.
2. Standard: ASSE 1003.
3. Pressure Rating: Initial working pressure of 150 psig.
4. Body: Bronze for NPS 2 and smaller; bronze or cast iron with interior lining that complies with AWWA C550 or that is FDA approved for NPS 2-1/2 and NPS 3.
5. Valves for Booster Heater Water Supply: Include integral bypass.
6. End Connections: Threaded or solder for NPS 2 and smaller; flanged or solder for NPS 2-1/2 and NPS 3.

B. Water-Control Valves:
1. Description: Pilot-operated, diaphragm-type, single-seated, main water-control valve.
2. Pressure Rating: Initial working pressure of 150 psig minimum with AWWA C550 or FDA-approved, interior epoxy coating. Include small pilot-control valve, restrictor device, specialty fittings, and sensor piping.
3. Main Valve Body: Cast- or ductile-iron body with AWWA C550 or FDA-approved, interior epoxy coating; or stainless steel body.
   a. Pattern: Angle or Globe-valve design.

b. Trim: Stainless steel.

4. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.

2.6 BALANCING VALVES

A. Copper-Alloy Calibrated Balancing Valves:

1. Type: Ball valve with two readout ports and memory-setting indicator.
2. Body: Brass or bronze.
3. Size: Same as connected piping, but not larger than NPS 2.
4. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

B. Automatic Flow Control Balancing Valves:

1. Flow Regulation: Plus or minus 5 percent over 95 percent of the working range.
2. Pressure Rating: 200 psig.
3. Size: NPS 2 or smaller.
4. Body: Stainless steel or brass.
5. Flow Cartridge: Stainless steel or antiscale polymer.
6. End Connections: Threaded or solder joint.

2.7 TEMPERATURE-ACTUATED, WATER MIXING VALVES

A. Water-Temperature Limiting Devices:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Acorn Engineering Company; a Division of Morris Group International.
   b. Apollo Flow Controls; Conbraco Industries, Inc.
   c. Cash Acme, A Division of Reliance Worldwide Corporation.
   d. Leonard Valve Company.
   e. POWERS; A WATTS Brand.
   f. Symmons Industries, Inc.
   g. TACO Comfort Solutions, Inc.
   h. WATTS.
   i. Zurn Industries, LLC.
2. Standard: ASSE 1070.
3. Pressure Rating: 125 psig.
4. Type: Thermostatically controlled, water mixing valve.
5. Material: Bronze body with corrosion-resistant interior components.
6. Connections: Threaded union inlets and outlet.
7. Accessories: Check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
8. Tempered-Water Setting: 110 deg F.
9. Valve Finish: Chrome plated.

B. Individual-Fixture, Water Tempering Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Lawler Manufacturing Company, Inc.
   b. POWERS; A WATTS Brand.
   c. Zurn Industries, LLC.
2. Standard: ASSE 1016, thermostatically controlled, water tempering valve.
3. Pressure Rating: 125 psig minimum unless otherwise indicated.

4. Material: Bronze body with corrosion-resistant interior components.
5. Temperature Control: Adjustable.
6. Connections: Threaded inlets and outlet.
7. Finish: Chrome plated.
8. Tempered-Water Setting: 110 deg-F.

2.8 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:

1. Pressure Rating: 125 psig minimum unless otherwise indicated.
2. Body: Bronze for NPS 2 and smaller; cast iron for NPS 2-1/2 and larger.
3. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
4. Screen: Stainless steel with round perforations unless otherwise indicated.
5. Drain: Pipe plug.

2.9 OUTLET BOXES

A. Clothes Washer Outlet Boxes:

1. Mounting: Recessed. Fire rated.
2. Material and Finish: Enameled-steel or epoxy-painted-steel, Enameled-steel, epoxy-painted-steel, or plastic, Plastic, Stainless steel box and faceplate.
3. Faucet: Combination valved fitting or separate hot- and cold-water valved fittings complying with ASME A112.18.1. Include garden-hose thread complying with ASME B1.20.7 on outlets.
4. Drain Outlet Connection: NPS 1-1/2.
5. Accessory: Water hammer arresters.
6. Supply Shutoff Fittings: NPS 1/2 gate, globe, or ball valves and NPS 1/2 copper, water tubing.
7. Drain: NPS 1-1/2 standpipe and P-trap for direct waste connection to drainage piping.
8. Inlet Hoses: Two 60-inch-long, rubber, household clothes washer inlet hoses with female, garden-hose-thread couplings. Include rubber washers.
9. Drain Hose: One 48-inch-long, rubber, household clothes washer drain hose with hooked end.

B. Icemaker Outlet Boxes:

1. Mounting: Recessed.
2. Material and Finish: Enameled-steel or epoxy-painted-steel, Enameled-steel, epoxy-painted-steel, or plastic, Plastic, Stainless steel box and faceplate.
3. Faucet: Valved fitting complying with ASME A112.18.1. Include NPS 1/2 or smaller copper tube outlet.
4. Accessory: Water hammer arrestor.
5. Supply Shutoff Fitting: NPS 1/2 gate, globe, or ball valve and NPS 1/2 copper, water tubing.

2.10 HOSE BIBBS

A. Hose Bibbs:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Jay R. Smith Mfg Co; a division of Morris Group International.
   b. MIFAB, Inc.
   c. Prier Products, Inc.
   d. WATTS.
   e. Woodford Manufacturing Company.

f. Zurn Industries, LLC.

2. Standard: ASME A112.18.1 for sediment faucets.
3. Body Material: Bronze.
4. Seat: Bronze, replaceable.
5. Supply Connections: NPS 1/2 or NPS 3/4 threaded or solder-joint inlet.
6. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
7. Pressure Rating: 125 psig.
8. Vacuum Breaker: Integral nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
9. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
10. Finish for Service Areas: Rough bronze.
11. Finish for Finished Rooms: Chrome or nickel plated.
12. Operation for Equipment Rooms: Wheel handle or operating key.
13. Operation for Service Areas: Operating key.
14. Operation for Finished Rooms: Wheel handle.
15. Include operating key with each operating-key hose bibb.
16. Include integral wall flange with each chrome- or nickel-plated hose bibb.

2.11 WALL HYDRANTS

A. Nonfreeze Wall Hydrants:

1. Standard: ASME A112.21.3M for concealed-outlet, self-draining wall hydrants.
2. Pressure Rating: 125 psig.
3. Operation: Loose key.
4. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
5. Inlet: NPS 3/4 or NPS 1.
6. Outlet, Concealed: With integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
7. Box: Deep, flush mounted with cover.
8. Box and Cover Finish: Polished nickel bronze.
9. Nozzle and Wall-Plate Finish: Polished nickel bronze.
10. Operating Keys(s): Two with each wall hydrant.

B. Nonfreeze, Hot- and Cold-Water Wall Hydrants Insert drawing designation if any:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Jay R. Smith Mfg Co; a division of Morris Group International.
   b. Josam Company.
   c. MIFAB, Inc.
   d. Prier Products, Inc.
   e. WATTS.
   f. Woodford Manufacturing Company.
   g. Zurn Industries, LLC.
2. Standard: ASME A112.21.3M for concealed-outlet, self-draining wall hydrants.
3. Pressure Rating: 125 psig.
4. Operation: Loose key.
5. Casing and Operating Rods: Of length required to match wall thickness. Include wall clamps.

6. Inlet: NPS 3/4 or NPS 1.
7. Outlet: Concealed.
8. Box: Deep, flush mounted with cover.
9. Box and Cover Finish: Polished nickel bronze.
10. Vacuum Breaker:
    a. Nonremovable, manual-drain-type, hose-connection vacuum breaker complying with ASSE 1011 or backflow preventer complying with ASSE 1052.
    b. Garden-hose thread complying with ASME B1.20.7 on outlet.
11. Operating Key(s): Two with each wall hydrant.

C. Nonfreeze Vacuum Breaker Wall Hydrants:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Jay R. Smith Mfg Co; a division of Morris Group International.
    b. Prier Products, Inc.
    c. WATTS.
    d. Woodford Manufacturing Company.
    e. Zurn Industries, LLC.
2. Standard: ASSE 1019, Type A or Type B.
3. Type: Automatic draining with integral air-inlet valve.
4. Classification: Type A, for automatic draining with hose removed or Type B, for automatic draining with hose removed or with hose attached and nozzle closed.
5. Pressure Rating: 125 psig.
6. Operation: Loose key or wheel handle.
7. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
8. Inlet: NPS 1/2 or NPS 3/4.
9. Outlet: Exposed with garden-hose thread complying with ASME B1.20.7.

2.12 GROUND HYDRANTS

A. Nonfreeze Ground Hydrants:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Jay R. Smith Mfg Co; a division of Morris Group International.
    b. Josam Company.
    c. MIFAB, Inc.
    d. Prier Products, Inc.
    e. WATTS.
    f. Woodford Manufacturing Company.
    g. Zurn Industries, LLC.
2. Standard: ASME A112.21.3M.
3. Type: Nonfreeze, concealed-outlet ground hydrant with box.
4. Operation: Loose key.
5. Casing and Operating Rod: Of at least length required for burial of valve below frost line.
6. Inlet: NPS 3/4.
7. Outlet: Garden-hose thread complying with ASME B1.20.7.
8. Drain: Designed with hole to drain into ground when shut off.
9. Box: Standard pattern with cover.

10. Box and Cover Finish: Rough bronze.
11. Operating Key(s): Two with each ground hydrant.
12. Vacuum Breaker: ASSE 1011.

2.13 POST HYDRANTS

A. Nonfreeze, Draining-Type Post Hydrants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Jay R. Smith Mfg Co; a division of Morris Group International.
   b. MIFAB, Inc.
   c. WATTS.
   d. Woodford Manufacturing Company.
   e. Zurn Industries, LLC.
2. Standard: ASME A112.21.3M.
3. Type: Nonfreeze, exposed-outlet post hydrant.
4. Operation: Loose key.
5. Casing and Operating Rod: Of at least length required for burial of valve below frost line.
6. Casing: Bronze with casing guard.
7. Inlet: NPS 3/4.
8. Outlet: Garden-hose thread complying with ASME B1.20.7.
9. Drain: Designed with hole to drain into ground when shut off.
10. Vacuum Breaker:
    a. Nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011 or backflow preventer complying with ASSE 1052.
    b. Garden-hose thread complying with ASME B1.20.7 on outlet.
11. Operating Key(s): Two with each loose-key-operation wall hydrant.

2.14 WATER-HAMMER ARRESTERS

A. Water-Hammer Arresters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. AMTROL, Inc.
   b. Jay R. Smith Mfg Co; a division of Morris Group International.
   c. Josam Company.
   d. MIFAB, Inc.
   e. Sioux Chief Manufacturing Company, Inc.
   f. WATTS.
   g. Zurn Industries, LLC.
2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Metal bellows or Piston.
4. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

2.15 TRAP-SEAL PRIMER DEVICE

A. Supply-Type, Trap-Seal Primer Device:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Jay R. Smith Mfg Co; a division of Morris Group International.
   b. Josam Company.

c. MIFAB, Inc.

d. Sioux Chief Manufacturing Company, Inc.

e. WATTS.

f. Zurn Industries, LLC.

2. Standard: ASSE 1018.

3. Pressure Rating: 125 psig minimum.

4. Body: Bronze.

5. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.

6. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.

7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

B. Drainage-Type, Trap-Seal Primer Device:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Jay R. Smith Mfg Co; a division of Morris Group International.

b. MIFAB, Inc.

c. Precision Plumbing Products.

d. Zurn Industries, LLC.

2. Standard: ASSE 1044, lavatory P-trap with NPS 3/8 minimum, trap makeup connection.

3. Size: NPS 1-1/4 minimum.

4. Material: Chrome-plated, cast brass.

2.16 FLEXIBLE CONNECTORS

A. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.

1. Working-Pressure Rating: Minimum 200 psig.

2. End Connections NPS 2 and Smaller: Threaded copper pipe or plain-end copper tube.

3. End Connections NPS 2-1/2 and Larger: Flanged copper alloy.

B. Stainless Steel-Hose Flexible Connectors: Corrugated-stainless steel tubing with stainless steel wire-braid covering and ends welded to inner tubing.

1. Working-Pressure Rating: Minimum 200 psig.

2. End Connections NPS 2 and Smaller: Threaded steel-pipe nipple.

3. End Connections NPS 2-1/2 and Larger: Flanged steel nipple.

2.17 WATER METERS

A. Displacement-Type Water Meters:

1. Standard: AWWA C700.

2. Pressure Rating: 150-psig working pressure.

3. Body Design: Nutating disc; totalization meter.

4. Registration: In gallons or cubic feet as required by utility company.

a. Remote Registration System: Encoder type complying with AWWA C707; modified with signal-transmitting assembly, low-voltage connecting wiring, and remote register assembly as required by utility company.

1) System shall be capable of transmitting data using AMR/AMI technology.

5. Case: Bronze.

6. End Connections: Threaded or flanged.

B. Turbine-Type Water Meters:

1. Standard: AWWA C701.

2. Pressure Rating: 150 psig working pressure.
3. Body Design: Turbine; totalization meter.
4. Registration: In gallons or cubic feet as required by utility company.
    a. Remote Registration System: Encoder type complying with AWWA C707; modified with signal-transmitting assembly, low-voltage connecting wiring, and remote register assembly as required by utility company.
        1) System shall be capable of transmitting data using AMR/AMI technology.
5. Case: Bronze.
6. End Connections: Threaded or flanged.

C. Compound-Type Water Meters:
1. Standard: AWWA C702.
2. Pressure Rating: 150-psig working pressure.
3. Body Design: With integral mainline and bypass meters; totalization meter.
4. Registration: In gallons or cubic feet as required by utility company.
    a. Remote Registration System: Encoder type complying with AWWA C707; modified with signal-transmitting assembly, low-voltage connecting wiring, and remote register assembly as required by utility company.
        1) System shall be capable of transmitting data using AMR/AMI technology.
5. Case: Bronze.
6. End Connections: Flanged.

D. Ultrasonic-Type Water Meters:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Badger Meter, Inc.
    b. Master Meter, Inc.
    c. Neptune Technology Group Inc.
2. Standard: Applicable portions of AWWA C700.
3. Pressure Rating: 150 psig working pressure.
4. Body Design: Ultrasonic open flow tube; totalization meter.
5. Registration: In gallons or cubic feet as required by utility company.
    a. Remote Registration System: Encoder type complying with AWWA C707; modified with signal-transmitting assembly, low-voltage connecting wiring, and remote register assembly as required by utility company.
        1) System shall be capable of transmitting data using AMR/AMI technology.
6. Case: Bronze.
7. End Connections: Threaded or flanged.

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPING SPECIALTIES

A. Backflow Preventers: Install in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
1. Locate backflow preventers in same room as connected equipment or system.
2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe-to-floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are unacceptable for this application.
3. Do not install bypass piping around backflow preventers.

B. Water Regulators: Install with inlet and outlet shutoff valves and bypass with memory-stop balancing valve. Install pressure gauges on inlet and outlet.

C. Water Control Valves: Install with inlet and outlet shutoff valves and bypass with globe valve. Install pressure gauges on inlet and outlet.

D. Automatic Water Shutoff Valves: Test for signal strength before valve installation. Install automatic shutoff valve downstream from main domestic water shutoff valve. Install valve controller in an accessible location with sensors in areas where water is likely to accumulate.

E. Balancing Valves: Install in locations where they can easily be adjusted. Set at indicated design flow rates.

F. Temperature-Actuated, Water Mixing Valves: Install with check stops or shutoff valves on inlets and with shutoff valve on outlet.

1. Install cabinet-type units recessed in or surface mounted on wall as specified.

G. Y-Pattern Strainers: For water, install on supply side of each control valve] water pressure-reducing valve, solenoid valve, and pump.

H. Outlet Boxes: Install boxes recessed in wall or surface mounted on wall. Install 1-1/2-by-3-1/2-inch fire-retardant-treated-wood blocking, wall reinforcement between studs. Comply with requirements for fire-retardant-treated-wood blocking in Section 06 10 00 "Rough Carpentry."

I. Hose Stations: Install with check stops or shutoff valves on inlets and with thermometer on outlet.

1. Install cabinet-type units recessed in or surface mounted on wall as specified. Install 1-1/2-by-3-1/2-inch fire-retardant-treated-wood blocking, wall reinforcement between studs. Comply with requirements for fire-retardant-treated-wood blocking in Section 06 10 00 "Rough Carpentry."

J. Ground Hydrants: Install with 1 cu. yd. of crushed gravel around drain hole. Set ground hydrants with box flush with grade.

K. Nonfreeze, Draining-Type Post Hydrants: Install with 1 cu. yd. of crushed gravel around drain hole. Set post hydrants in concrete paving or in 1 cu. ft. of concrete block at grade.

L. Nonfreeze, Nondraining-Type Post Hydrants: Set in concrete or pavement.

M. Nonfreeze, Sanitary Yard Hydrants: Set with riser pipe in concrete or pavement. Do not encase canister in concrete.

N. Nonfreeze, Draining-Type Roof Hydrants: Install with drain connection piped to nearest floor drain or to the exterior.

O. Water-Hammer Arresters: Install in water piping in accordance with PDI-WH 201.

P. Supply-Type, Trap-Seal Primer Device: Install with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

Q. Drainage-Type, Trap-Seal Primer Device: Install as lavatory trap with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting.

R. Trap-Seal Primer Systems: Install with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust system for proper flow.

3.2 PIPING CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping specialties adjacent to equipment and machines, allow space for service and maintenance.

3.3 ELECTRICAL CONNECTIONS

A. Connect wiring in accordance with Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

B. Ground equipment in accordance with Section 26 05 26 "Grounding and Bonding for Electrical Systems."

C. Install electrical devices furnished by manufacturer, but not factory mounted, in accordance with NFPA 70 and NECA 1.

3.4 CONTROL CONNECTIONS

A. Connect control wiring in accordance with Section 26 05 23 "Control-Voltage Electrical Power Cables."

3.5 IDENTIFICATION

A. Plastic Labels for Equipment: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:

1. Vacuum breakers.
2. Backflow preventers.
3. Water pressure-reducing valves.
4. Automatic water shutoff valve systems.
5. Balancing valves.
6. Temperature-actuated, water mixing valves.
7. Outlet boxes.
8. Hose stations.
9. Wall hydrants.
10. Ground hydrants.
11. Post hydrants.
12. Roof hydrants.
13. Trap-seal primer device.
14. Trap-seal primer systems.
15. Water meters.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

3.6 ADJUSTING

A. Set field-adjustable pressure set points of water pressure-reducing valves.

B. Set field-adjustable flow set points of balancing valves.

C. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

D. Adjust each pressure vacuum breaker, reduced-pressure-principle backflow preventer, double-check, backflow-prevention assembly and double-check, detector-assembly backflow preventer in accordance with manufacturer's written instructions, authorities having jurisdiction and the device's reference standard.

3.7 FIELD QUALITY CONTROL

A. Perform the following tests and inspections.

1. Test each pressure vacuum breaker, reduced-pressure-principle backflow preventer, double-check, backflow-prevention assembly and double-check, detector-assembly backflow preventer according to authorities having jurisdiction and the device's reference standard.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION

SECTION 22 11 23 - FACILITY NATURAL-GAS PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Pipes, tubes, and fittings.
2. Piping specialties.
3. Piping and tubing joining materials.
4. Manual gas shutoff valves.
5. Motorized gas valves.
6. Pressure regulators.
7. Service meters.
8. Dielectric fittings.

1.3 DEFINITIONS

A. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of the following:

1. Piping specialties.
2. Corrugated, stainless-steel tubing with associated components.
3. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
4. Pressure regulators. Indicate pressure ratings and capacities.
5. Service meters. Indicate pressure ratings and capacities. Include bypass fittings and meter bars supports.
6. Dielectric fittings.

B. Shop Drawings: For facility natural-gas piping layout. Include plans, piping layout and elevations, sections, and details for fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to building structure. Detail location of anchors, alignment guides, and expansion joints and loops.

1. Shop Drawing Scale: 1/4 inch per foot.
2. Detail mounting, supports, and valve arrangements for pressure regulator assembly.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans and details, drawn to scale, on which natural-gas piping is shown and coordinated with other installations, using input from installers of the items involved.

B. Site Survey: Plans, drawn to scale, on which natural-gas piping is shown and coordinated with other services and utilities.

C. Qualification Data: For qualified professional engineer.

D. Welding certificates.

E. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For pressure regulators and service meters to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Handling Flammable Liquids: Remove and dispose of liquids from existing natural-gas piping according to requirements of authorities having jurisdiction.

B. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

C. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating, and protect from direct sunlight.

D. Protect stored PE pipes and valves from direct sunlight.

1.9 PROJECT CONDITIONS

A. Perform site survey, research public utility records, and verify existing utility locations. Contact utility-locating service for area where Project is located.

B. Interruption of Existing Natural-Gas Service: Do not interrupt natural-gas service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide purging and startup of natural-gas supply according to requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of natural-gas service.

2. Do not proceed with interruption of natural-gas service without Owner's written permission.

1.10 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

B. Coordinate requirements for access panels and doors for valves installed concealed behind finished surfaces. Comply with requirements in Section 08 31 13 "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Minimum Operating-Pressure Ratings:

1. Piping and Valves: 100 psig minimum unless otherwise indicated.

2. Service Regulators: 100 psig minimum unless otherwise indicated.

3. Minimum Operating Pressure of Service Meter: 65 psig.

B. Natural-Gas System Pressures within Buildings: Two pressure ranges. Primary pressure is more than 0.5 psig but not more than 2 psig, and is reduced to secondary pressure of 0.5 psig or less.

2.2 PIPES, TUBES, AND FITTINGS

A. Steel Pipe: ASTM A53/A53M, black steel, Schedule 40, Type E or S, Grade B.

1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.

2. Wrought-Steel Welding Fittings: ASTM A234/A234M for butt welding and socket welding.

3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.

4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
    a. Material Group: 1.1.
    b. End Connections: Threaded or butt welding to match pipe.
    c. Lapped Face: Not permitted underground.
    d. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
    e. Bolts and Nuts: ASME B18.2.1, carbon steel aboveground and stainless steel underground.
5. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.
    a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.
6. Mechanical Couplings:
    a. Stainless-steel flanges and tube with epoxy finish.
    b. Buna-nitrile seals.
    c. Stainless-steel bolts, washers, and nuts.
    d. Coupling shall be capable of joining PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.
    e. Steel body couplings installed underground on plastic pipe shall be factory equipped with anode.

B. Corrugated, Stainless-Steel Tubing: Comply with ANSI/IAS LC 1.
1. Tubing: ASTM A240/A240M, corrugated, Series 300 stainless steel.
2. Coating: PE with flame retardant.
    a. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
        1) Flame-Spread Index: 25 or less.
        2) Smoke-Developed Index: 50 or less.
3. Fittings: Copper-alloy mechanical fittings with ends made to fit and listed for use with corrugated stainless-steel tubing and capable of metal-to-metal seal without gaskets. Include brazing socket or threaded ends complying with ASME B1.20.1.
4. Striker Plates: Steel, designed to protect tubing from penetrations.
5. Manifolds: Malleable iron or steel with factory-applied protective coating. Threaded connections shall comply with ASME B1.20.1 for pipe inlet and corrugated tubing outlets.
6. Operating-Pressure Rating: 5 psig.

C. Drawn-Temper Copper Tube: Comply with ASTM B88, Type K.
1. Copper Fittings: ASME B16.22, wrought copper, and streamlined pattern.
2. Bronze Flanges and Flanged Fittings: ASME B16.24, Class 150.
    a. Gasket Material: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
    b. Bolts and Nuts: ASME B18.2.1, carbon steel or stainless steel.
3. Protective Coating for Underground Tubing: Factory-applied, extruded PE a minimum of 0.022 inch thick.

D. Annealed-Temper Copper Tube: Comply with ASTM B88, Type K.
1. Copper Fittings: ASME B16.22, wrought copper, and streamlined pattern.
2. Flare Fittings: Comply with ASME B16.26 and SAE J513.
    a. Copper fittings with long nuts.
    b. Metal-to-metal compression seal without gasket.

c. Dryseal threads complying with ASME B1.20.3.

3. Protective Coating for Underground Tubing: Factory-applied, extruded PE a minimum of 0.022 inch thick.

E. Tin-Lined Copper Tube: ASTM B280, seamless, annealed, with interior tin-plated lining.

1. Flare Fittings: Comply with ASME B16.26 and SAE J513.

a. Copper fittings with long nuts.

b. Metal-to-metal compression seal without gasket.

c. Dryseal threads complying with ASME B1.20.3.

F. PE Pipe: ASTM D2513, SDR 11.

1. PE Fittings: ASTM D2683, socket-fusion type or ASTM D3261, butt-fusion type with dimensions matching PE pipe.

2. PE Transition Fittings: Factory-fabricated fittings with PE pipe complying with ASTM D2513, SDR 11; and steel pipe complying with ASTM A53/A53M, black steel, Schedule 40, Type E or S, Grade B.

3. Anodeless Service-Line Risers: Factory fabricated and leak tested.

a. Underground Portion: PE pipe complying with ASTM D2513, SDR 11 inlet.

b. Casing: Steel pipe complying with ASTM A53/A53M, Schedule 40, black steel, Type E or S, Grade B, with corrosion-protective coating covering. Vent casing aboveground.

c. Aboveground Portion: PE transition fitting.

d. Outlet shall be threaded or flanged or suitable for welded connection.

e. Tracer wire connection.

f. Ultraviolet shield.

g. Stake supports with factory finish to match steel pipe casing or carrier pipe.

4. Transition Service-Line Risers: Factory fabricated and leak tested.

a. Underground Portion: PE pipe complying with ASTM D2513, SDR 11 inlet connected to steel pipe complying with ASTM A53/A53M, Schedule 40, Type E or S, Grade B, with corrosion-protective coating for aboveground outlet.

b. Outlet shall be threaded or flanged or suitable for welded connection.

c. Bridging sleeve over mechanical coupling.

d. Factory-connected anode.

e. Tracer wire connection.

f. Ultraviolet shield.

g. Stake supports with factory finish to match steel pipe casing or carrier pipe.

5. Plastic Mechanical Couplings, NPS 1-1/2 and Smaller: Capable of joining PE pipe to PE pipe.

a. PE body with molded-in, stainless-steel support ring.

b. Buna-nitrile seals.

c. Acetal collets.

d. Electro-zinc-plated steel stiffener.

6. Plastic Mechanical Couplings, NPS 2 and Larger: Capable of joining PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.

a. Fiber-reinforced plastic body.

b. PE body tube.

c. Buna-nitrile seals.

d. Acetal collets.

e. Stainless-steel bolts, nuts, and washers.

7. Steel Mechanical Couplings: Capable of joining plain-end PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.
    a. Stainless-steel flanges and tube with epoxy finish.
    b. Buna-nitrile seals.
    c. Stainless-steel bolts, washers, and nuts.
    d. Factory-installed anode for steel-body couplings installed underground.

2.3 PIPING SPECIALTIES

A. Appliance Flexible Connectors:
1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
2. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.
3. Outdoor, Appliance Flexible Connectors: Comply with ANSI Z21.75.
4. Corrugated stainless-steel tubing with polymer coating.
5. Operating-Pressure Rating: 0.5 psig.
6. End Fittings: Zinc-coated steel.
7. Threaded Ends: Comply with ASME B1.20.1.
8. Maximum Length: 72 inches

B. Quick-Disconnect Devices: Comply with ANSI Z21.41.
1. Copper-alloy convenience outlet and matching plug connector.
2. Nitrile seals.
3. Hand operated with automatic shutoff when disconnected.
4. For indoor or outdoor applications.
5. Adjustable, retractable restraining cable.

C. Y-Pattern Strainers:
1. Body: ASTM A126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

D. Basket Strainers:
1. Body: ASTM A126, Class B, high-tensile cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

E. T-Pattern Strainers:
1. Body: Ductile or malleable iron with removable access coupling and end cap for strainer maintenance.
2. End Connections: Grooved ends.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 57 percent free area.
4. CWP Rating: 750 psig.

F. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

2.4 JOINING MATERIALS

A. Joint Compound and Tape: Suitable for natural gas.

B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

C. Brazing Filler Metals: Alloy with melting point greater than 1000 deg F complying with AWS A5.8/A5.8M. Brazing alloys containing more than 0.05 percent phosphorus are prohibited.

2.5 MANUAL GAS SHUTOFF VALVES

A. See "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles for where each valve type is applied in various services.

B. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.

1. CWP Rating: 125 psig.
2. Threaded Ends: Comply with ASME B1.20.1.
3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
4. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
6. Service Mark: Valves 1-1/4 inches to NPS 2 shall have initials "WOG" permanently marked on valve body.

C. General Requirements for Metallic Valves, NPS 2-1/2 and Larger: Comply with ASME B16.38.

1. CWP Rating: 125 psig.
2. Flanged Ends: Comply with ASME B16.5 for steel flanges.
3. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
4. Service Mark: Initials "WOG" shall be permanently marked on valve body.

D. One-Piece, Bronze Ball Valve with Bronze Trim: MSS SP-110.

1. Ball: Chrome-plated brass.
2. Stem: Bronze; blowout proof.
3. Seats: Reinforced TFE; blowout proof.
4. Packing: Separate packnut with adjustable-stem packing threaded ends.
5. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
6. CWP Rating: 600 psig.
7. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
8. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

E. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.

1. Ball: Chrome-plated bronze.
2. Stem: Bronze; blowout proof.
3. Seats: Reinforced TFE; blowout proof.
4. Packing: Threaded-body packnut design with adjustable-stem packing.
5. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
6. CWP Rating: 600 psig.
7. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.

8. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

F. Two-Piece, Regular-Port Bronze Ball Valves with Bronze Trim: MSS SP-110.

1. Body: Bronze, complying with ASTM B584.
2. Ball: Chrome-plated bronze.
3. Stem: Bronze; blowout proof.
4. Seats: Reinforced TFE.
5. Packing: Threaded-body packnut design with adjustable-stem packing.
6. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
7. CWP Rating: 600 psig.
8. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
9. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

G. Bronze Plug Valves: MSS SP-78.

1. Body: Bronze, complying with ASTM B584.
2. Plug: Bronze.
3. Ends: Threaded, socket, or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
4. Operator: Square head or lug type with tamperproof feature where indicated.
5. Pressure Class: 125 psig.
6. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
7. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

H. Cast-Iron, Nonlubricated Plug Valves: MSS SP-78.

1. Body: Cast iron, complying with ASTM A126, Class B.
2. Plug: Bronze or nickel-plated cast iron.
3. Seat: Coated with thermoplastic.
4. Stem Seal: Compatible with natural gas.
5. Ends: Threaded or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
6. Operator: Square head or lug type with tamperproof feature where indicated.
7. Pressure Class: 125 psig.
8. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
9. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

I. Cast-Iron, Lubricated Plug Valves: MSS SP-78.

1. Body: Cast iron, complying with ASTM A126, Class B.
2. Plug: Bronze or nickel-plated cast iron.
3. Seat: Coated with thermoplastic.
4. Stem Seal: Compatible with natural gas.
5. Ends: Threaded or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
6. Operator: Square head or lug type with tamperproof feature where indicated.
7. Pressure Class: 125 psig.
8. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
9. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

J. Valve Boxes:

1. Cast-iron, two-section box.
2. Top section with cover with "GAS" lettering.
3. Bottom section with base to fit over valve and barrel a minimum of 5 inches in diameter.
4. Adjustable cast-iron extensions of length required for depth of bury.
5. Include tee-handle, steel operating wrench with socket end fitting valve nut or flat head, and with stem of length required to operate valve.

2.6 MOTORIZED GAS VALVES

A. Automatic Gas Valves: Comply with ANSI Z21.21.

1. Body: Brass or aluminum.
2. Seats and Disc: Nitrile rubber.
3. Springs and Valve Trim: Stainless steel.
4. Normally closed.
5. Visual position indicator.
6. Electrical operator for actuation by appliance automatic shutoff device.

B. Electrically Operated Valves: Comply with UL 429.

1. Pilot operated.
2. Body: Brass or aluminum.
3. Seats and Disc: Nitrile rubber.
4. Springs and Valve Trim: Stainless steel.
5. 120-V ac, 60 Hz, Class B, continuous-duty molded coil, and replaceable.
6. NEMA ICS 6, Type 4, coil enclosure.
7. Normally closed.
8. Visual position indicator.

2.7 PRESSURE REGULATORS

A. General Requirements:

1. Single stage and suitable for natural gas.
2. Steel jacket and corrosion-resistant components.
3. Elevation compensator.
4. End Connections: Threaded for regulators NPS 2 and smaller; flanged for regulators NPS 2-1/2 and larger.

B. Service Pressure Regulators: Comply with ANSI Z21.80.

1. Body and Diaphragm Case: Cast iron or die-cast aluminum.
2. Springs: Zinc-plated steel; interchangeable.
3. Diaphragm Plate: Zinc-plated steel.
4. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
5. Orifice: Aluminum; interchangeable.
6. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
7. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
8. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
9. Overpressure Protection Device: Factory mounted on pressure regulator.
10. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.

11. Maximum Inlet Pressure: 100 psig.

C. Line Pressure Regulators: Comply with ANSI Z21.80.

1. Body and Diaphragm Case: Cast iron or die-cast aluminum.
2. Springs: Zinc-plated steel; interchangeable.
3. Diaphragm Plate: Zinc-plated steel.
4. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
5. Orifice: Aluminum; interchangeable.
6. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
7. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
8. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
9. Overpressure Protection Device: Factory mounted on pressure regulator.
10. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
11. Maximum Inlet Pressure: 10 psig.

D. Appliance Pressure Regulators: Comply with ANSI Z21.18.

1. Body and Diaphragm Case: Die-cast aluminum.
2. Springs: Zinc-plated steel; interchangeable.
3. Diaphragm Plate: Zinc-plated steel.
4. Seat Disc: Nitrile rubber.
5. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
6. Factory-Applied Finish: Minimum three-layer polyester and polyurethane paint finish.
7. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.
8. Maximum Inlet Pressure: 5 psig.

2.8 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:

1. Description:
   a. Standard: ASSE 1079.
   b. Pressure Rating: 125 psig minimum at 180 deg F.
   c. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:

1. Description:
   a. Standard: ASSE 1079.
   b. Factory-fabricated, bolted, companion-flange assembly.
   c. Pressure Rating: 125 psig minimum at 180 deg F.
   d. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Insulating Kits:

1. Description:
   a. Nonconducting materials for field assembly of companion flanges.
   b. Pressure Rating: 150 psig.

c. Gasket: Neoprene or phenolic.

d. Bolt Sleeves: Phenolic or polyethylene.

e. Washers: Phenolic with steel backing washers.

2.9 LABELING AND IDENTIFYING

A. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored yellow.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for natural-gas piping system to verify actual locations of piping connections before equipment installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Close equipment shutoff valves before turning off natural gas to premises or piping section.

B. Inspect natural-gas piping according to NFPA 54 to determine that natural-gas utilization devices are turned off in piping section affected.

C. Comply with NFPA 54 requirements for prevention of accidental ignition.

3.3 OUTDOOR PIPING INSTALLATION

A. Comply with NFPA 54 for installation and purging of natural-gas piping.

B. Install underground, natural-gas piping buried at least 36 inches below finished grade. Comply with requirements in Section 31 20 00 "Earth Moving" for excavating, trenching, and backfilling.

1. If natural-gas piping is installed less than 36 inches below finished grade, install it in containment conduit.

C. Install underground, PE, natural-gas piping according to ASTM D2774.

D. Steel Piping with Protective Coating:

1. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.

2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.

3. Replace pipe having damaged PE coating with new pipe.

E. Copper Tubing with Protective Coating:

1. Apply joint cover kits over tubing to cover, seal, and protect joints.

2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.

F. Install fittings for changes in direction and branch connections.

G. Install pressure gage downstream from each service regulator.

3.4 INDOOR PIPING INSTALLATION

A. Comply with NFPA 54 for installation and purging of natural-gas piping.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.

D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

G. Locate valves for easy access.

H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.

I. Install piping free of sags and bends.

J. Install fittings for changes in direction and branch connections.

K. Verify final equipment locations for roughing-in.

L. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.

M. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.

1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.

N. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.

O. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.

P. Concealed Location Installations: Except as specified below, install concealed natural-gas piping and piping installed under the building in containment conduit constructed of steel pipe with welded joints as described in Part 2. Install a vent pipe from containment conduit to outdoors and terminate with weatherproof vent cap.

1. Above Accessible Ceilings: Natural-gas piping, fittings, valves, and regulators may be installed in accessible spaces without containment conduit.

2. In Floors: Install natural-gas piping with welded or brazed joints and protective coating in cast-in-place concrete floors. Cover piping to be cast in concrete slabs with minimum of 1-1/2 inches of concrete. Piping may not be in physical contact with other metallic structures such as reinforcing rods or electrically neutral conductors. Do not embed piping in concrete slabs containing quick-set additives or cinder aggregate.

3. In Floor Channels: Install natural-gas piping in floor channels. Channels must have cover and be open to space above cover for ventilation.

4. In Walls or Partitions: Protect tubing installed inside partitions or hollow walls from physical damage using steel striker barriers at rigid supports.

a. Exception: Tubing passing through partitions or walls does not require striker barriers.

5. Prohibited Locations:

a. Do not install natural-gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.

b. Do not install natural-gas piping in solid walls or partitions.

Q. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

R. Connect branch piping from top or side of horizontal piping.

S. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.

T. Do not use natural-gas piping as grounding electrode.

U. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.

V. Install pressure gage downstream from each line regulator.

W. Install sleeves for piping penetrations of walls, ceilings, and floors.

X. Install sleeve seals for piping penetrations of concrete walls and slabs.

Y. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.5 SERVICE-METER ASSEMBLY INSTALLATION

A. Install service-meter assemblies aboveground, on concrete bases.

B. Install metal shutoff valves upstream from service regulators. Shutoff valves are not required at second regulators if two regulators are installed in series.

C. Install strainer on inlet of service-pressure regulator and meter set.

D. Install service regulators mounted outside with vent outlet horizontal or facing down. Install screen in vent outlet if not integral with service regulator.

E. Install metal shutoff valves upstream from service meters. Install dielectric fittings downstream from service meters.

F. Install service meters downstream from pressure regulators.

G. Install metal bollards to protect meter assemblies. Comply with requirements in Section 05 50 00 "Metal Fabrications" for pipe bollards.

3.6 VALVE INSTALLATION

A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing, aluminum, or copper connector.

B. Install underground valves with valve boxes.

C. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.

D. Install earthquake valves aboveground outside buildings according to listing.

E. Install anode for metallic valves in underground PE piping.

3.7 PIPING JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints:

1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
2. Cut threads full and clean using sharp dies.
3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Welded Joints:

1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
2. Bevel plain ends of steel pipe.
3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.

F. Flanged Joints: Install gasket material, size, type, and thickness appropriate for natural-gas service. Install gasket concentrically positioned.

G. Flared Joints: Cut tubing with roll cutting tool. Flare tube end with tool to result in flare dimensions complying with SAE J513. Tighten finger tight, then use wrench. Do not overtighten.

H. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D2657.

1. Plain-End Pipe and Fittings: Use butt fusion.

2. Plain-End Pipe and Socket Fittings: Use socket fusion.

3.8 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for seismic-restraint devices specified.

B. Comply with requirements for pipe hangers and supports specified.

C. Install hangers for steel piping and copper tubing, with maximum horizontal spacing and minimum rod diameters, to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

D. Install hangers for corrugated stainless-steel tubing, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

E. Support horizontal piping within 12 inches of each fitting.

F. Support vertical runs of steel piping and copper tubing to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

G. Support vertical runs of corrugated stainless-steel tubing to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.9 CONNECTIONS

A. Connect to utility's gas main according to utility's procedures and requirements.

B. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.

C. Install piping adjacent to appliances to allow service and maintenance of appliances.

D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.

E. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.10 LABELING AND IDENTIFYING

A. Comply with requirements in specifications and plans for piping and valve identification.

B. Install detectable warning tape directly above gas piping, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.11 PAINTING

A. Comply with requirements in Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting" for painting interior and exterior natural-gas piping.

B. Paint exposed, exterior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.

1. Alkyd System: MPI EXT 5.1D.

a. Prime Coat: Alkyd anticorrosive metal primer.

b. Intermediate Coat: Exterior alkyd enamel matching topcoat.

c. Topcoat: Exterior alkyd enamel (flat).

d. Color: Gray.

C. Paint exposed, interior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.

1. Latex Over Alkyd Primer System: MPI INT 5.1Q.
    a. Prime Coat: Alkyd anticorrosive metal primer.
    b. Topcoat: Interior latex (flat).
    c. Color: Gray.
2. Alkyd System: MPI INT 5.1E.
    a. Prime Coat: Alkyd anticorrosive metal primer.
    b. Intermediate Coat: Interior alkyd matching topcoat.
    c. Topcoat: Interior alkyd (flat).
    d. Color: Gray.

D. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

3.12 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base.
1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Use 3000-psig, 28-day, compressive-strength concrete and reinforcement as specified in Section 03 30 00 "Cast-in-Place Concrete."

3.13 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:
1. Test, inspect, and purge natural gas according to NFPA 54 and authorities having jurisdiction.

C. Natural-gas piping will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.14 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain earthquake valves.

3.15 OUTDOOR PIPING SCHEDULE

A. Underground natural-gas piping shall be:
1. PE pipe and fittings joined by heat fusion, or mechanical couplings; service-line risers with tracer wire terminated in an accessible location.

B. Aboveground natural-gas piping shall be one of the following:
1. Steel pipe with malleable-iron fittings and threaded joints.
2. Steel pipe with wrought-steel fittings and welded joints.
3. Annealed-temper copper tube with wrought-copper fittings and brazed joints.

C. Branch Piping in Cast-in-Place Concrete to Single Appliance: Annealed-temper copper tube with wrought-copper fittings and brazed joints. Install piping embedded in concrete with no joints in concrete.

D. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

3.16 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES LESS THAN 0.5 PSIG

A. Aboveground, branch piping NPS 1 and smaller shall be the following:

1. Corrugated stainless-steel tubing with mechanical fittings having socket or threaded ends to match adjacent piping.
2. Annealed-temper, tin-lined copper tube with flared joints and fittings.
3. Annealed-temper, copper tube with wrought-copper fittings and brazed joints.
4. Aluminum tube with flared fittings and joints.
5. Steel pipe with malleable-iron fittings and threaded joints.

B. Aboveground, distribution piping shall be one of the following:

1. Steel pipe with malleable-iron fittings and threaded joints.
2. Steel pipe with wrought-steel fittings and welded joints.
3. Drawn-temper copper tube with wrought-copper fittings and brazed joints.

C. Underground, below building, piping shall be one of the following:

1. Steel pipe with malleable-iron fittings and threaded joints.
2. Steel pipe with wrought-steel fittings and welded joints.

D. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

E. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.

3.17 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES MORE THAN 0.5 PSIG AND LESS THAN 5 PSIG

A. Aboveground, branch piping NPS 1 and smaller shall be one of the following:

1. Corrugated stainless-steel tubing with mechanical fittings having socket or threaded ends to match adjacent piping.
2. Annealed-temper, tin-lined copper tube with flared joints and fittings.
3. Annealed-temper, copper tube with wrought-copper fittings and brazed joints.
4. Aluminum tube with flared fittings and joints.
5. Steel pipe with malleable-iron fittings and threaded joints.

B. Aboveground, distribution piping shall be one of the following:

1. Steel pipe with malleable-iron fittings and threaded joints.
2. Steel pipe with steel welding fittings and welded joints.
3. Drawn-temper copper tube with wrought-copper fittings and brazed joints.

C. Underground, below building, piping shall be one of the following:

1. Steel pipe with malleable-iron fittings and threaded joints.
2. Steel pipe with wrought-steel fittings and welded joints.

D. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat underground pipe and fittings with protective coating for steel piping.

E. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.

3.18 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES MORE THAN 5 PSIG

A. Aboveground Piping: Maximum operating pressure more than 5 psig.

B. Aboveground, Branch Piping: Steel pipe with steel welding fittings and welded joints.

C. Aboveground, distribution piping shall be one of the following:

1. Steel pipe with steel welding fittings and welded joints.
2. Drawn-temper copper tube with wrought-copper fittings and brazed joints.

D. Underground, below building, piping shall be one of the following:

1. Steel pipe with malleable-iron fittings and threaded joints.
2. Steel pipe with wrought-steel fittings and welded joints.

E. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

F. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.

3.19 UNDERGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

A. Connections to Existing Gas Piping: Use valve and fitting assemblies made for tapping utility's gas mains and listed by an NRTL.

B. Underground:

1. PE valves.
2. NPS 2 and Smaller: Bronze plug valves.
3. NPS 2-1/2 and Larger: Cast-iron, nonlubricated plug valves.

3.20 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

A. Valves for pipe sizes NPS 2 and smaller at service meter shall be one of the following:

1. One-piece, bronze ball valve with bronze trim.
2. Bronze plug valve.

B. Valves for pipe sizes NPS 2-1/2 and larger at service meter shall be one of the following:

1. Bronze plug valve.
2. Cast-iron, nonlubricated plug valve.

C. Distribution piping valves for pipe sizes NPS 2 and smaller shall be one of the following:

1. One-piece, bronze ball valve with bronze trim.
2. Bronze plug valve.

D. Distribution piping valves for pipe sizes NPS 2-1/2 and larger shall be one of the following:

1. Bronze plug valve.
2. Cast-iron, lubricated plug valve.

E. Valves in branch piping for single appliance shall be one of the following:

1. One-piece, bronze ball valve with bronze trim.
2. Bronze plug valve.

END OF SECTION

SECTION 22 13 16 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Hub-and-spigot, cast-iron soil pipe and fittings.
2. Hubless, cast-iron soil pipe and fittings.
3. Ductile-iron pipe and fittings.
4. Copper tube and fittings.
5. PVC pipe and fittings.
6. Specialty pipe fittings.
7. Encasement for underground metal piping.

B. Related Requirements:

1. Section 22 13 13 "Facility Sanitary Sewers" for sanitary sewerage piping and structures outside the building.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1. Product Data: For adhesives, indicating VOC content.
2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.

C. Shop Drawings: For hubless, single-stack drainage system. Include plans, elevations, sections, and details.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.5 FIELD CONDITIONS

A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Architect no fewer than two days in advance of proposed interruption of sanitary waste service.
2. Do not proceed with interruption of sanitary waste service without Owner's written permission.

1.6 WARRANTY

A. Listed manufacturers to provide labeling and warranty of their respective products.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water.

2.2 PIPING MATERIALS

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.3 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Service and Extra Heavy class(es).

B. Gaskets: ASTM C 564, rubber.

C. Caulking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.4 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. CISPI, Hubless-Piping Couplings:

1. Standards: ASTM C 1277 and CISPI 310.

2. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

C. Heavy-Duty, Hubless-Piping Couplings:

1. Standards: ASTM C 1277 and ASTM C 1540.

2. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

D. Cast-Iron, Hubless-Piping Couplings:

1. Standard: ASTM C 1277.

2. Description: Two-piece ASTM A 48/A 48M, cast-iron housing; stainless-steel bolts and nuts; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.5 DUCTILE-IRON PIPE AND FITTINGS

A. Ductile-Iron, Mechanical-Joint Piping:

1. Ductile-Iron Pipe: AWWA C151/A21.51, with mechanical-joint bell and plain spigot ends unless grooved or flanged ends are indicated.

B. Ductile-Iron, Push-on-Joint Piping:

1. Ductile-Iron Pipe: AWWA C151/A21.51, with push-on-joint bell and plain spigot ends unless grooved or flanged ends are indicated.

C. Ductile-Iron, Grooved-Joint Piping: AWWA C151/A21.51, with round-cut-grooved ends according to AWWA C606.

D. Ductile-Iron, Grooved-End Pipe Appurtenances:

1. Grooved-End, Ductile-Iron Fittings: ASTM A 536 ductile-iron castings, with dimensions matching AWWA C110/A 21.10 ductile-iron pipe or AWWA C153/A 21.53 ductile-iron fittings, and complying with AWWA C606 for grooved ends.

2. Grooved Mechanical Couplings for Ductile-Iron Pipe: ASTM F 1476, Type I. Include ferrous housing sections with continuous curved keys; EPDM-rubber center-leg gasket suitable for hot and cold water; and bolts and nuts.

2.6 COPPER TUBE AND FITTINGS

A. Copper Type DWV Tube: ASTM B 306, drainage tube, drawn temper.

B. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.

C. Hard Copper Tube: ASTM B 88, Type L and Type M, water tube, drawn temper.

D. Soft Copper Tube: ASTM B 88, Type L, water tube, annealed temper.

E. Copper Pressure Fittings:

1. Copper Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.

2. Copper Unions: MSS SP-123, copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

F. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.

G. Solvent Cement: ASTM D 2235.

1. Verify solvent cement has a VOC content of 325 g/L or less.

2. Verify solvent cement complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.7 PVC PIPE AND FITTINGS

A. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

B. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.

C. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.

D. Adhesive Primer: ASTM F 656.

1. Verify adhesive primer complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

E. Solvent Cement: ASTM D 2564.

1. Verify solvent cement has a VOC content of 510 g/L or less.

2.8 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

2. Unshielded, Nonpressure Transition Couplings:

a. Standard: ASTM C 1173.

b. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.

c. End Connections: Same size as and compatible with pipes to be joined.

d. Sleeve Materials:

1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.

2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.

3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

3. Shielded, Nonpressure Transition Couplings:

a. Standard: ASTM C 1460.

b. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

c. End Connections: Same size as and compatible with pipes to be joined.

4. Pressure Transition Couplings:

a. Standard: AWWA C219.

b. Description: Metal, sleeve-type same size as, with pressure rating at least equal to, and ends compatible with, pipes to be joined.

c. Center-Sleeve Material: Manufacturer's standard.

d. Gasket Material: Natural or synthetic rubber.

e. Metal Component Finish: Corrosion-resistant coating or material.

B. Dielectric Fittings:

1. Dielectric Unions:

a. Description:

1) Standard: ASSE 1079.
2) Pressure Rating: 125 psig minimum at 180 deg F.
3) End Connections: Solder-joint copper alloy and threaded ferrous.

2. Dielectric Nipples:
   a. Description:
      1) Standard: IAPMO PS 66.
      2) Electroplated steel nipple.
      3) Pressure Rating: 300 psig at 225 deg F.
      4) End Connections: Male threaded or grooved.
      5) Lining: Inert and noncorrosive, propylene.

2.9 ENCASEMENT FOR UNDERGROUND METAL PIPING

A. Standard: ASTM A 674 or AWWA C105/A 21.5.

B. Material: Linear low-density polyethylene film of 0.008-inch or high-density, cross-laminated polyethylene film of 0.004-inch minimum thickness.

C. Form: Sheet or tube.

D. Color: Black or natural.

PART 3 - EXECUTION

3.1 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Section 31 20 00 "Earth Moving."

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.
   1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
   2. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Lay buried building waste piping beginning at low point of each system.
   1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.
   2. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
   3. Maintain swab in piping and pull past each joint as completed.

K. Install soil and waste and vent piping at the following minimum slopes unless otherwise indicated:

1. Building Sanitary Waste: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
2. Horizontal Sanitary Waste Piping: 2 percent downward in direction of flow.
3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

L. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
1. Install encasement on underground piping according to ASTM A 674 or AWWA C105/A 21.5.

M. Install steel piping according to applicable plumbing code.

N. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."

O. Install aboveground PVC piping according to ASTM D 2665.

P. Install underground PVC piping according to ASTM D 2321.

Q. Install engineered soil and waste and vent piping systems as follows:
1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
2. Hubless, Single-Stack Drainage System: Comply with ASME B16.45 and hubless, single-stack aerator fitting manufacturer's written installation instructions.
3. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.
4. Install encasement on piping according to ASTM A 674 or AWWA C105/A 21.5.

R. Plumbing Specialties:
1. Install backwater valves in sanitary waster gravity-flow piping.
a. Comply with requirements for backwater valves specified in Section 22 13 19 "Sanitary Waste Piping Specialties."
2. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary waste gravity-flow piping.
a. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping.
b. Comply with requirements for cleanouts specified in Section 22 13 19 "Sanitary Waste Piping Specialties."
3. Install drains in sanitary waste gravity-flow piping.
a. Comply with requirements for drains specified in Section 22 13 19 "Sanitary Waste Piping Specialties."

S. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

T. Install sleeves for piping penetrations of walls, ceilings, and floors.
1. Comply with requirements for sleeves specified in Section 22 05 17 "Sleeves and Sleeve Seals for Plumbing Piping."

U. Install sleeve seals for piping penetrations of concrete walls and slabs.
1. Comply with requirements for sleeve seals specified in Section 22 05 17 "Sleeves and Sleeve Seals for Plumbing Piping."

V. Install escutcheons for piping penetrations of walls, ceilings, and floors.
1. Comply with requirements for escutcheons specified in Section 22 05 18 "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

B. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead-and-oakum calked joints.

C. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1.

1. Cut threads full and clean using sharp dies.
2. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
    a. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
    b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
    c. Do not use pipe sections that have cracked or open welds.

E. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.

F. Grooved Joints: Cut groove ends of pipe according to AWWA C606. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections, over gasket, with keys seated in piping grooves. Install and tighten housing bolts.

G. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 appendixes.

3.4 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in ODs.
2. In Waste Drainage Piping: Unshielded, nonpressure transition couplings.

3.5 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements for pipe hanger and support devices and installation specified in Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment."

1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
2. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
3. Vertical Piping: MSS Type 8 or Type 42, clamps.
4. Install individual, straight, horizontal piping runs:
    a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
5. Support pipe rolls on trapeze.
6. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Install hangers for cast-iron, steel and copper soil piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

C. Install hangers for PVC piping, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

D. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.

E. Support vertical runs of cast iron, steel, stainless-steel and copper soil piping to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

F. Support vertical runs of PVC piping to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect waste and vent piping to the following:

1. Plumbing Fixtures: Connect waste piping in sizes indicated, but not smaller than required by plumbing code.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect waste and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
5. Comply with requirements for backwater valves, cleanouts and drains specified in Section 22 13 19 "Sanitary Waste Piping Specialties."
6. Equipment: Connect waste piping as indicated.

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

3.7 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping.

B. Comply with requirements for identification specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

3.8 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary waste and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.
    a. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced waste and vent piping until it has been tested and approved.
    a. Expose work that was covered or concealed before it was tested.
3. Roughing-in Plumbing Test Procedure: Test waste and vent piping except outside leaders on completion of roughing-in.
    a. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water.
    b. From 15 minutes before inspection starts to completion of inspection, water level must not drop.
    c. Inspect joints for leaks.
4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight.
    a. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg.

b. Use U-tube or manometer inserted in trap of water closet to measure this pressure.

c. Air pressure must remain constant without introducing additional air throughout period of inspection.

d. Inspect plumbing fixture connections for gas and water leaks.

5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.

6. Prepare reports for tests and required corrective action.

3.9 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect sanitary waste and vent piping during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

D. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

E. Repair damage to adjacent materials caused by waste and vent piping installation.

3.10 PIPING SCHEDULE

A. Aboveground, soil and waste piping NPS 4 and smaller shall be the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.

2. Hubless, cast-iron soil pipe and fittings and hubless, single-stack aerator fittings; CISPI heavy-duty hubless-piping couplings; and coupled joints.

3. Copper Type DWV tube, copper drainage fittings, and soldered joints.

4. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

B. Aboveground, soil and waste piping NPS 5 and larger shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.

2. Hubless, cast-iron soil pipe and fittings and hubless, single-stack aerator fittings; CISPI heavy-duty hubless-piping couplings; and coupled joints.

3. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

C. Aboveground, vent piping NPS 4 and smaller shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.

2. Hubless, cast-iron soil pipe and fittings; CISPI heavy-duty hubless-piping couplings; and coupled joints.

3. Copper Type DWV tube, copper drainage fittings, and soldered joints.

a. Option for Vent Piping, NPS 2-1/2 and NPS 3-1/2: Hard copper tube, Type M; copper pressure fittings; and soldered joints.

4. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

D. Aboveground, vent piping NPS 5 and larger shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.

2. Hubless, cast-iron soil pipe and fittings; CISPI heavy-duty hubless-piping couplings; and coupled joints.

3. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

E. Underground, soil, waste, and vent piping NPS 4 and smaller shall be any of the following:

1. Extra Heavy Service class, cast-iron soil piping; gaskets; and gasketed calking materials; and calked joints.

2. Hubless, cast-iron soil pipe and fittings; CISPI heavy-duty cast-iron hubless-piping couplings; and coupled joints.

3. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

F. Underground, soil and waste piping NPS 5 and larger shall be any of the following:

1. Extra Heavy Service class, cast-iron soil piping; gaskets; and gasketed calking materials; and calked joints.
2. Hubless, cast-iron soil pipe and fittings; CISPI heavy-duty cast-iron hubless-piping couplings; coupled joints.
3. Solid-wall PVC pipe; PVC socket fittings; and solvent-cemented joints.

END OF SECTION

SECTION 22 13 19.13 - SANITARY DRAINS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Floor drains.
2. Floor sinks.
3. Trench drains.
4. Channel drainage systems.

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene styrene.
B. FRP: Fiberglass-reinforced plastic.
C. HDPE: High-density polyethylene.
D. PE: Polyethylene.
E. PP: Polypropylene.
F. PVC: Polyvinyl chloride.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 DRAIN ASSEMBLIES

A. Sanitary drains shall bear label, stamp, or other markings of specified testing agency.
B. Comply with NSF 14 for plastic sanitary piping specialty components.

2.2 FLOOR DRAINS

A. REFERENCE PLUMBING PLANS

2.3 FLOOR SINKS

A. REFERENCE PLUMBING PLANS

2.4 TRENCH DRAINS

A. REFERENCE PLUMBING PLANS

2.5 CHANNEL DRAINAGE SYSTEMS

A. REFERENCE PLUMBING PLANS

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

1. Position floor drains for easy access and maintenance.
2. Set floor drains below elevation of surrounding finished floor to allow floor drainage.
3. Set with grates depressed according to the following drainage area radii:

a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.

4. Install floor-drain flashing collar or flange, so no leakage occurs between drain and adjoining flooring.
    a. Maintain integrity of waterproof membranes where penetrated.
5. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

B. Install trench drains at low points of surface areas to be drained.
1. Set grates of drains flush with finished surface, unless otherwise indicated.

C. Comply with ASME A112.3.1 for installation of stainless-steel channel drainage systems.
1. Install on support devices, so that top will be flush with adjacent surface.

D. Install FRP channel drainage system components on support devices, so that top will be flush with adjacent surface.

E. Install plastic channel drainage system components on support devices, so that top will be flush with adjacent surface.

F. Install open drain fittings with top of hub 2 inches above floor.

3.2 CONNECTIONS

A. Comply with requirements in Section 22 13 16 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Comply with requirements in Section 22 13 19 "Sanitary Waste Piping Specialties" for backwater valves, air admittance devices and miscellaneous sanitary drainage piping specialties.

C. Install piping adjacent to equipment to allow service and maintenance.

3.3 LABELING AND IDENTIFYING

A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

3.4 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION

SECTION 22 13 19 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Backwater valves.
2. Cleanouts.
3. Air-admittance valves.
4. Miscellaneous sanitary drainage piping specialties.

B. Related Requirements:

1. Section 22 13 23 "Sanitary Waste Interceptors" for metal and concrete interceptors outside the building, grease interceptors, grease-removal devices, oil interceptors, and solids interceptors.

1.3 DEFINITIONS

A. ABS: Acrylonitrile butadiene styrene.

B. PVC: Polyvinyl chloride.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Show fabrication and installation details for frost-resistant vent terminals.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For sanitary waste piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTIONS

A. Sanitary waste piping specialties shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14 for plastic sanitary waste piping specialty components.

2.2 CLEANOUTS

A. Cast-Iron Exposed Cleanouts:

1. Standard: ASME A112.36.2M.
2. Size: Same as connected drainage piping
3. Body Material: Hub-and-spigot, cast-iron soil pipe T-branch, Hubless, cast-iron soil pipe test tee as required to match connected piping.
4. Closure: Countersunk or raised-head, brass plug.
5. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

B. Stainless Steel Exposed Cleanouts:

1. Standard: ASME A112.3.1.
2. Size: Same as connected drainage piping.
3. Body Material: Stainless steel tee with side cleanout as required to match connected piping.

4. Closure: Stainless steel plug with seal.

C. Cast-Iron Exposed Floor Cleanouts:

1. Standard: ASME A112.36.2M for adjustable housing threaded, adjustable housing cleanout.
2. Size: Same as connected branch.
3. Type: Adjustable housing Threaded, adjustable housing.
4. Body or Ferrule: Cast iron.
5. Outlet Connection: Inside calk.
6. Closure: Brass plug with straight threads and gasket.
7. Adjustable Housing Material: ` Plastic with threads.
8. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
9. Frame and Cover Shape: Round.
10. Top-Loading Classification: Extra Heavy Duty.
11. Riser: ASTM A74, Extra-Heavy Service Class, cast-iron drainage pipe fitting and riser to cleanout.

D. Stainless Steel Exposed Floor Cleanouts:

1. Standards: ASME A112.3.1; NSF listed.
2. Size: Same as connected branch.
3. Housing: Type 304 stainless steel.
4. Closure: Stainless steel with seal.
5. Riser: ASTM A74, Extra-Heavy Service Class, drainage pipe fitting and riser to cleanout.
6. Body or Ferrule: Stainless steel.
7. Outlet Connection: Inside caulk.
8. Adjustable Housing Material: Cast iron or Plastic with threads.
9. Frame and Cover Material and Finish: Stainless steel.
10. Frame and Cover Shape: Round.
11. Top-Loading Classification: Extra Heavy Light Medium Duty.

E. Cast-Iron Wall Cleanouts Insert drawing designation, if any:

1. Standard: ASME A112.36.2M. Include wall access.
2. Size: Same as connected drainage piping.
3. Body: Hub-and-spigot, cast-iron soil pipe T-branch, Hubless, cast-iron soil pipe test tee as required to match connected piping.
4. Closure Plug:
   a. Brass.
   b. Countersunk or raised head.
   c. Drilled and threaded for cover attachment screw.
   d. Size: Same as or not more than one size smaller than cleanout size.
5. Wall Access, Cover Plate: Round, flat, chrome-plated brass or stainless steel cover plate with screw.
6. Wall Access, Frame and Cover: Round, nickel-bronze, copper-alloy, or stainless steel wall-installation frame and cover.

2.3 AIR-ADMITTANCE VALVES

A. Fixture Air-Admittance Valves:

1. Standard: ASSE 1051, Type A for single fixture or Type B for branch piping.
2. Housing: Plastic.
3. Operation: Mechanical sealing diaphragm.

4. Size: Same as connected fixture or branch vent piping.

B. Stack Air-Admittance Valves:

1. Standard: ASSE 1050 for vent stacks.
2. Housing: Plastic.
3. Operation: Mechanical sealing diaphragm.
4. Size: Same as connected stack vent or vent stack.

C. Wall Box for Air-Admittance Valves:

1. Description: White plastic housing with white plastic grille, made for recessed installation. Include bottom pipe connection and space to contain one air-admittance valve.
2. Size: Approximately 6 inches wide by 6 inches high by 4 inches deep.

2.4 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Open Drains:

1. Description: Shop or field fabricate from ASTM A74, Service Class, hub-and-spigot, cast-iron soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C564 rubber gaskets.
2. Size: Same as connected waste piping with increaser fitting of size indicated.

B. Deep-Seal Traps:

1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
2. Size: Same as connected waste piping.
   a. NPS 2: 4-inch-minimum water seal.
   b. NPS 2-1/2 and Larger: 5-inch-minimum water seal.

C. Floor-Drain, Trap-Seal Primer Fittings Insert drawing designation, if any:

1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
2. Size: Same as floor drain outlet with NPS 1/2 side inlet.

D. Floor-Drain, Inline Trap Seal:

1. Description: Inline floor drain trap seal, forming a physical barrier to slow trap evaporation while not impeding flow from drain.
2. Material: Polymer.
3. Standard: Tested and certified in accordance with ASSE 1072.
4. Listing: ICC-ES or IAPMO listed.
5. Size: Same as floor drain outlet or strainer throat.

E. Air-Gap Fittings:

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.
5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

F. Sleeve Flashing Device:

1. Description: Manufactured, cast-iron fitting, with clamping device that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 1 inch above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
2. Size: As required for close fit to riser or stack piping.

G. Stack Flashing Fittings:

1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
2. Size: Same as connected stack vent or vent stack.

H. Vent Caps:

1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
2. Size: Same as connected stack vent or vent stack.

I. Frost-Resistant Vent Terminals:

1. Description: Manufactured or shop-fabricated assembly constructed of copper, lead-coated copper, or galvanized steel.
2. Design: To provide 1-inch enclosed air space between outside of pipe and inside of flashing collar extension, with counterflashing.

J. Expansion Joints:

1. Standard: ASME A112.6.4.
2. Body: Cast iron with bronze sleeve, packing, and gland.
3. End Connections: Matching connected piping.
4. Size: Same as connected soil, waste, or vent piping.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install backwater valves in building drain piping.

1. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.

B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
4. Locate at base of each vertical soil and waste stack.

C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

E. Install fixture air-admittance valves on fixture drain piping.

F. Install stack air-admittance valves at top of stack vent and vent stack piping.

G. Install air-admittance-valve wall boxes recessed in wall.

H. Assemble open drain fittings and install with top of hub 1 inch above floor.

I. Install deep-seal traps on floor drains and other waste outlets, if indicated.

J. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.

1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
2. Size: Same as floor drain inlet.

K. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

L. Install sleeve and sleeve seals with each riser and stack passing through floors with waterproof membrane.

M. Install wood-blocking reinforcement for wall-mounting-type specialties.

N. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

3.2 PIPING CONNECTIONS

A. Comply with requirements in Section 22 13 16 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment, to allow service and maintenance.

3.3 LABELING AND IDENTIFYING

A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit.

1. Nameplates and signs are specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

3.4 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION

SECTION 22 34 00 - FUEL-FIRED, DOMESTIC-WATER HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Commercial, power-burner, gas-fired, storage, domestic-water heaters.
2. Commercial, power-vent, gas-fired, storage, domestic-water heaters.
3. Commercial, direct-vent, gas-fired, storage, domestic-water heater.
4. Commercial, gas-fired, high-efficiency, storage, domestic-water heaters.
5. Commercial, coil-type, finned-tube, gas-fired, domestic-water heaters.
6. Commercial, grid-type, finned-tube, gas-fired, domestic-water heaters.
7. Gas-fired, tankless, domestic-water heaters.
8. Residential, direct-vent, gas-fired, storage, domestic-water heaters.
9. Residential, power-vent, gas-fired, storage, domestic-water heaters.
10. Commercial, gas- and oil-fired, domestic-water heaters.
11. Domestic-water heater accessories.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Sustainable Design Submittals:

1. Water Heaters: Product Data for water heater compliance with ASHRAE's "Advanced Energy Design Guides."

C. Shop Drawings:

1. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Equipment room drawing or BIM model, drawn to scale, on which the items described in this Section are shown and coordinated with all building trades.

B. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.

C. Source quality-control reports.

D. Field quality-control reports.

E. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fuel-fired, domestic-water heaters to include in emergency, operation, and maintenance manuals.

1.6 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of fuel-fired, domestic-water heaters that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including storage tank and supports.
b. Faulty operation of controls.
c. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Periods: From date of Substantial Completion.
   a. Commercial, Gas-Fired, Storage, Domestic-Water Heaters:
      1) Storage Tank: Five years.
      2) Controls and Other Components: Two year(s).
   b. Commercial, Finned-Tube, Gas-Fired, Domestic-Water Heaters:
      1) Heat Exchanger: Five years.
      2) Controls and Other Components: Two year(s).
      3) Separate Hot-Water Storage Tanks: Five years.
   c. Gas-Fired, Tankless, Domestic-Water Heaters:
      1) Heat Exchanger: Five years.
      2) Controls and Other Components: Three years.
   d. Residential, Gas-Fired, Storage, Domestic-Water Heaters:
      1) Storage Tank: Five years.
      2) Controls and Other Components: Three years.
   e. Commercial, Gas- and Oil-Fired, Domestic-Water Heaters:
      1) Storage Tank: Five years.
      2) Burner: Two year(s).
      3) Controls and Other Components: Two years.
   f. Expansion Tanks: Five years.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and use.

B. ASHRAE/IES Compliance: Fabricate and label fuel-fired, domestic-water heaters to comply with ASHRAE/IES 90.1.

C. ASME Compliance:
   1. Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
   2. Where ASME-code construction is indicated, fabricate and label commercial, finned-tube, domestic-water heaters to comply with ASME Boiler and Pressure Vessel Code: Section IV.

D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 and NSF 372.

2.2 COMMERCIAL, GAS-FIRED, STORAGE, DOMESTIC-WATER HEATERS

A. Commercial, Atmospheric, Gas-Fired, Storage, Domestic-Water Heaters:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. A. O. Smith Corporation.
      b. Bradford White Corporation.
      c. Lochinvar, LLC.
      d. PVI; A WATTS Brand.
      e. Rheem Manufacturing Company.
      f. State Industries.
   2. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.

3. Standard: ANSI Z21.10.3/CSA 4.3.
4. Storage-Tank Construction: ASME-code steel with 150-psig working-pressure rating.
    a. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.
        1) NPS 2 and Smaller: Threaded ends in accordance with ASME B1.20.1.
        2) NPS 2-1/2 and Larger: Flanged ends in accordance with ASME B16.5 for steel and stainless steel flanges and in accordance with ASME B16.24 for copper and copper-alloy flanges.
    b. Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
    c. Lining: Cement, Glass, Nickel plate, Phenolic coating, Sheet copper, complying with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending lining into and through tank fittings and outlets.
5. Factory-Installed, Storage-Tank Appurtenances:
    a. Anode Rod: Replaceable magnesium.
    b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
    c. Drain Valve: Corrosion-resistant metal with hose-end connection.
    d. Insulation: Comply with ASHRAE/IES 90.1. Surround entire storage tank except connections and controls.
    e. Jacket: Steel with enameled finish.
    f. Burner: For use with atmospheric, gas-fired, domestic-water heaters and natural-gas fuel.
    g. Ignition: Standing pilot or ANSI Z21.20/CSA C22.2 No. 60730-2-5, electric, automatic, gas-ignition system.
    h. Temperature Control: Adjustable thermostat.
    i. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
    j. Combination Temperature-and-Pressure Relief Valves: ANSI Z21.22/CSA 4.4. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select one relief valve with sensing element that extends into storage tank.
6. Special Requirements: NSF 5 construction.
7. Draft Hood: Draft diverter, complying with ANSI Z21.12.

B. Commercial, Power-Burner, Gas-Fired, Storage, Domestic-Water Heaters:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. A. O. Smith Corporation.
    b. Precision Boilers.
    c. PVI; A WATTS Brand.
    d. State Industries.
2. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
3. Standard: ANSI Z21.10.3/CSA 4.3.
4. Storage-Tank Construction: ASME-code steel with 150-psig working-pressure rating.
    a. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.
        1) NPS 2 and Smaller: Threaded ends in accordance with ASME B1.20.1.

2) NPS 2-1/2 and Larger: Flanged ends in accordance with ASME B16.5 for steel and stainless steel flanges and in accordance with ASME B16.24 for copper and copper-alloy flanges.

b. Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.

c. Lining: Cement, Glass, Nickel plate, Phenolic coating, Sheet copper, complying with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending lining into and through tank fittings and outlets.

5. Factory-Installed, Storage-Tank Appurtenances:

a. Anode Rod: Replaceable magnesium.

b. Dip Tube: Required unless cold-water inlet is near bottom of tank.

c. Drain Valve: Corrosion-resistant metal with hose-end connection.

d. Insulation: Comply with ASHRAE/IES 90.1. Surround entire storage tank except connections and controls.

e. Jacket: Steel with enameled finish.

f. Burner: UL 795 for power-burner, gas-fired, domestic-water heaters and natural-gas fuel.

g. Automatic Ignition: ANSI Z21.20/CSA C22.2 No. 60730-2-5, electric, automatic, gas-ignition system.

h. Temperature Control: Adjustable thermostat.

i. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.

j. Combination Temperature-and-Pressure Relief Valves: ANSI Z21.22/CSA 4.4. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select one relief valve with sensing element that extends into storage tank.

6. Draft Hood: Draft diverter, complying with ANSI Z21.12.

C. Commercial, Power-Vent, Gas-Fired, Storage, Domestic-Water Heaters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. A. O. Smith Corporation.

b. Bradford White Corporation.

c. Rheem Manufacturing Company.

d. State Industries.

2. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.

3. Standard: ANSI Z21.10.3/CSA 4.3.

4. Storage-Tank Construction: ASME-code steel with 150-psig working-pressure rating.

a. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.

1) NPS 2 and Smaller: Threaded ends in accordance with ASME B1.20.1.

2) NPS 2-1/2 and Larger: Flanged ends in accordance with ASME B16.5 for steel and stainless steel flanges and in accordance with ASME B16.24 for copper and copper-alloy flanges.

5. Factory-Installed, Storage-Tank Appurtenances:

a. Anode Rod: Replaceable magnesium.

b. Dip Tube: Required unless cold-water inlet is near bottom of tank.

c. Drain Valve: Corrosion-resistant metal with hose-end connection.

d. Insulation: Comply with ASHRAE/IES 90.1. Surround entire storage tank except connections and controls.

e. Jacket: Steel with enameled finish.

f. Burner: For use with power-vent, gas-fired, domestic-water heaters and natural-gas fuel.

g. Automatic Ignition: ANSI Z21.20/CSA C22.2 No. 60730-2-5, electric, automatic, gas-ignition system.

h. Temperature Control: Adjustable thermostat.

i. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.

j. Combination Temperature-and-Pressure Relief Valves: ANSI Z21.22/CSA 4.4. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select one relief valve with sensing element that extends into storage tank.

6. Special Requirements: NSF 5 construction.

7. Power-Vent System: Exhaust fan, interlocked with burner.

D. Commercial, Direct-Vent, Gas-Fired, Storage, Domestic-Water Heaters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Bradford White Corporation.

b. Lochinvar, LLC.

c. State Industries.

2. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.

3. Standard: ANSI Z21.10.1/CSA 4.1.

4. Storage-Tank Construction: Steel.

a. Tappings: ASME B1.20.1 pipe thread.

b. Pressure Rating: 150 psig.

c. Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending lining material into tappings.

5. Factory-Installed Storage-Tank Appurtenances:

a. Anode Rod: Replaceable magnesium.

b. Dip Tube: Required unless cold-water inlet is near bottom of tank.

c. Drain Valve: Corrosion-resistant metal with hose-end connection.

d. Insulation: Comply with ASHRAE/IES 90.1.

e. Jacket: Steel with enameled finish.

f. Heat-Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.

g. Burner: For use with direct-vent, gas-fired, domestic-water heaters and natural-gas fuel.

h. Ignition: Standing pilot or ANSI Z21.20/CSA C22.2 No. 60730-2-5, electric, automatic, gas-ignition system.

i. Temperature Control: Adjustable thermostat.

j. Combination Temperature-and-Pressure Relief Valve: ANSI Z21.22/CSA 4.4. Include relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select relief valve with sensing element that extends into storage tank.

6. Direct-Vent System: Through-wall or roof, coaxial- or double-channel vent assembly with domestic-water heater manufacturers' outside intake/exhaust screen.

E. Commercial, Gas-Fired, High-Efficiency, Storage, Domestic-Water Heaters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. A. O. Smith Corporation.
   b. Bradford White Corporation.
   c. PVI; A WATTS Brand.
   d. Rheem Manufacturing Company.
   e. State Industries.
2. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
3. Standard: ANSI Z21.10.3/CSA 4.3.
4. Description: Manufacturer's proprietary design to provide at least 95 percent combustion efficiency at optimum operating conditions.
5. Factory-Installed, Storage-Tank Appurtenances:
   a. Anode Rod: Replaceable magnesium.
   b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
   c. Drain Valve: Corrosion-resistant metal with hose-end connection.
   d. Insulation: Comply with ASHRAE/IES 90.1. Surround entire storage tank except connections and controls.
   e. Jacket: Steel with enameled finish.
   f. Burner or Heat Exchanger: Comply with UL 795 or approved testing agency requirements for gas-fired, high-efficiency, domestic-water heaters and natural-gas fuel.
   g. Temperature Control: Adjustable thermostat.
   h. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
   i. Combination Temperature-and-Pressure Relief Valves: ANSI Z21.22/CSA 4.4. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select one relief valve with sensing element that extends into storage tank.
6. Draft Hood: Draft diverter, complying with ANSI Z21.12.

2.3 COMMERCIAL, FINNED-TUBE, GAS-FIRED, DOMESTIC-WATER HEATERS

A. Commercial, Coil-Type, Finned-Tube, Gas-Fired, Domestic-Water Heaters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. A. O. Smith Corporation.
   b. Bradford White Corporation.
   c. Laars Heating Systems Company; a subsidiary of Bradford White Corporation.
   d. Raypac.
2. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
3. Standard: ANSI Z21.13/CSA 4.9 for hot-water-supply boilers.
4. Description: Packaged unit with boiler, separate hot-water storage tank, pump, piping, and controls.
5. Boiler Construction: ASME code with 160-psig working-pressure rating for hot-water-supply boiler, domestic-water heater.

a. Heat Exchanger: Helix or spiral, finned-copper-tube coils with bronze headers.

b. Connections: Factory fabricated of materials compatible with boiler. Attach to boiler before testing.

1) NPS 2 and Smaller: Threaded ends in accordance with ASME B1.20.1.

2) NPS 2-1/2 and Larger: Flanged ends in accordance with ASME B16.5 for steel and stainless steel flanges and in accordance with ASME B16.24 for copper and copper-alloy flanges.

6. Boiler Appurtenances:

a. Insulation: Comply with ASHRAE/IES 90.1. Surround entire boiler except connections and controls.

b. Jacket: Steel with enameled finish.

c. Burner: For use with coil-type, finned-tube, gas-fired, domestic-water heaters and natural-gas fuel.

d. Automatic Ignition: ANSI Z21.20/CSA C22.2 No. 60730-2-5, intermittent electronic-ignition system.

e. Temperature Control: Adjustable, storage-tank temperature-control fitting and flow switch, interlocked with circulator and burner.

f. Safety Control: Automatic, high-temperature-limit cutoff device or system.

7. Support: Steel base or skids.

8. Draft Hood: Draft diverter, complying with ANSI Z21.12.

9. Hot-Water Storage Tank: Connected with piping to circulating pump and domestic-water heater.

a. Construction: In accordance with ASME Boiler and Pressure Vessel Code: Section VIII, steel with 150-psig working-pressure rating.

b. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.

1) NPS 2 and Smaller: Threaded ends in accordance with ASME B1.20.1.

2) NPS 2-1/2 and Larger: Flanged ends in accordance with ASME B16.5 for steel and stainless steel flanges and in accordance with ASME B16.24 for copper and copper-alloy flanges.

c. Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.

10. Factory-Installed, Storage-Tank Appurtenances:

a. Anode Rods: Factory installed, magnesium.

b. Drain Valve: Corrosion-resistant metal with hose-end connection.

c. Insulation: Comply with ASHRAE/IES 90.1. Surround entire storage tank except connections and controls.

d. Jacket: Steel with enameled finish.

e. Combination Temperature-and-Pressure Relief Valves: ANSI Z21.22/CSA 4.4. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select one relief valve with sensing element that extends into storage tank.

11. Circulating Pump: UL 778, all-bronze, centrifugal, overhung-impeller, separately coupled in-line pump as defined in HI 1.1-1.2 and HI 1.3. Include mechanical seals, 125-psig minimum working-pressure rating, and 225 deg F continuous-water-temperature rating.

12. Piping: Copper tubing; copper, solder-joint fittings; and brazed or flanged joints.

13. Mounting: Domestic-water heater, tank, and accessories factory mounted on skids.

B. Commercial, Grid-Type, Finned-Tube, Gas-Fired, Domestic-Water Heaters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. A. O. Smith Corporation.
   b. Bradford White Corporation.
   c. Laars Heating Systems Company; a subsidiary of Bradford White Corporation.
   d. Lochinvar, LLC.
   e. Raypak.
   f. RBI.
   g. Rheem Manufacturing Company.
2. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
3. Standard: ANSI Z21.13/CSA 4.9 for hot-water-supply boilers.
4. Description: Packaged unit with boiler, storage tank, pump, piping, and controls.
5. Boiler Construction: ASME code with 160-psig working-pressure rating for hot-water-boiler-type, domestic-water heater.
   a. Heat Exchanger: Horizontal, straight, finned-copper tubes with bronze headers.
   b. Connections: Factory fabricated of materials compatible with boiler. Attach to boiler before testing.
      1) NPS 2 and Smaller: Threaded ends in accordance with ASME B1.20.1.
      2) NPS 2-1/2 and Larger: Flanged ends in accordance with ASME B16.5 for steel and stainless steel flanges and in accordance with ASME B16.24 for copper and copper-alloy flanges.
6. Boiler Appurtenances:
   a. Insulation: Comply with ASHRAE/IES 90.1. Surround entire boiler except connections and controls.
   b. Jacket: Steel with enameled finish.
   c. Burner: For use with grid-type, finned-tube, gas-fired, domestic-water heaters and natural-gas fuel.
   d. Automatic Ignition: ANSI Z21.20/CSA C22.2 No. 60730-2-5, intermittent electronic-ignition system.
   e. Temperature Control: Adjustable, storage-tank temperature-control fitting and flow switch, interlocked with circulator and burner.
   f. Safety Control: Automatic, high-temperature-limit cutoff device or system.
7. Support: Steel base or skids.
8. Draft Hood: Draft diverter, complying with ANSI Z21.12.
9. Factory-Installed, Storage-Tank Appurtenances:
   a. Anode Rods: Factory installed, magnesium.
   b. Drain Valve: Corrosion-resistant metal with hose-end connection.
   c. Insulation: Comply with ASHRAE/IES 90.1. Surround entire storage tank except connections and controls.
   d. Jacket: Steel with enameled finish.
   e. Combination Temperature-and-Pressure Relief Valves: ANSI Z21.22/CSA 4.4. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select one relief valve with sensing element that extends into storage tank.
10. Circulating Pump: UL 778, all-bronze, centrifugal, overhung-impeller, separately coupled in-line pump as defined in HI 1.1-1.2 and HI 1.3. Include mechanical seals, 125-psig minimum working-pressure rating, and 225 deg F continuous-water-temperature rating.

11. Piping: Copper tubing; copper, solder-joint fittings; and brazed or flanged joints.
12. Mounting: Domestic-water heater, tank, and accessories factory mounted on skids.

2.4 GAS-FIRED, TANKLESS, DOMESTIC-WATER HEATERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. A. O. Smith Corporation.
   2. Bradford White Corporation.
   3. Laars Heating Systems Company; a subsidiary of Bradford White Corporation.
   4. NORITZ America Corp.
   5. Rheem Manufacturing Company.
   6. Rinnai Corporation.
   7. State Industries.
B. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
C. Standard: ANSI Z21.10.3/CSA 4.3 for gas-fired, instantaneous, domestic-water heaters for indoor application.
D. Construction: Copper piping or tubing complying with NSF 61 and NSF 372 barrier materials for potable water, without storage capacity.
   1. Tappings: ASME B1.20.1 pipe thread.
   2. Pressure Rating: 150 psig.
   3. Heat Exchanger: Copper tubing or Stainless steel.
   4. Insulation: Comply with ASHRAE/IES 90.1.
   5. Jacket: Metal, with enameled finish, or plastic.
   6. Burner: For use with tankless, domestic-water heaters and natural-gas fuel.
   7. Automatic Ignition: Manufacturer's proprietary system for automatic, gas ignition.
   8. Temperature Control: Adjustable thermostat.
E. Support: Bracket for wall mounting.

2.5 RESIDENTIAL, GAS-FIRED, STORAGE, DOMESTIC-WATER HEATERS

A. Residential, Atmospheric, Gas-Fired, Storage, Domestic-Water Heaters:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. A. O. Smith Corporation.
      b. Bradford White Corporation.
      c. Lochinvar, LLC.
      d. Rheem Manufacturing Company.
      e. State Industries.
   2. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
   3. Standard: ANSI Z21.10.1/CSA 4.1.
   4. Storage-Tank Construction: Steel.
      a. Tappings: ASME B1.20.1 pipe thread.
      b. Pressure Rating: 150 psig.
      c. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending lining material into tappings.
   5. Factory-Installed, Storage-Tank Appurtenances:
      a. Anode Rod: Replaceable magnesium.
      b. Dip Tube: Required unless cold-water inlet is near bottom of tank.

c. Drain Valve: Corrosion-resistant metal with hose-end connection.

d. Insulation: Comply with ASHRAE/IES 90.1.

e. Jacket: Steel with enameled finish.

f. Heat-Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.

g. Burner: For use with atmospheric, gas-fired, domestic-water heaters and natural-gas fuel.

h. Ignition: Standing pilot or ANSI Z21.20/CSA C22.2 No. 60730-2-5, electric, automatic, gas-ignition system.

i. Temperature Control: Adjustable thermostat.

j. Combination Temperature-and-Pressure Relief Valve: ANSI Z21.22/CSA 4.4. Include relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select relief valve with sensing element that extends into storage tank.

6. Draft Hood: Low-profile-type draft diverter, complying with ANSI Z21.12.

B. Residential, Direct-Vent, Gas-Fired, Storage, Domestic-Water Heaters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. A. O. Smith Corporation.

b. Bradford White Corporation.

c. Lochinvar, LLC.

d. Rheem Manufacturing Company.

e. State Industries.

2. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.

3. Standard: ANSI Z21.10.1/CSA 4.1.

4. Storage-Tank Construction: Steel.

a. Tappings: ASME B1.20.1 pipe thread.

b. Pressure Rating: 150 psig.

c. Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending lining material into tappings.

5. Factory-Installed, Storage-Tank Appurtenances:

a. Anode Rod: Replaceable magnesium.

b. Dip Tube: Required unless cold-water inlet is near bottom of tank.

c. Drain Valve: Corrosion-resistant metal with hose-end connection.

d. Insulation: Comply with ASHRAE/IES 90.1.

e. Jacket: Steel with enameled finish.

f. Heat-Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.

g. Burner: For use with direct-vent, gas-fired, domestic-water heaters and natural-gas fuel.

h. Ignition: Standing pilot or ANSI Z21.20/CSA C22.2 No. 60730-2-5, electric, automatic, gas-ignition system.

i. Temperature Control: Adjustable thermostat.

j. Combination Temperature-and-Pressure Relief Valve: ANSI Z21.22/CSA 4.4. Include relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select relief valve with sensing element that extends into storage tank.

6. Direct-Vent System: Through-wall or roof, coaxial- or double-channel vent assembly with domestic-water heater manufacturers' outside intake/exhaust screen.

C. Residential, Power-Vent, Gas-Fired, Storage, Domestic-Water Heaters:

1. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
2. Standard: ANSI Z21.10.1/CSA 4.1.
3. Storage-Tank Construction: Steel.
    a. Tappings: ASME B1.20.1 pipe thread.
    b. Pressure Rating: 150 psig.
    c. Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending lining material into tappings.
4. Factory-Installed, Storage-Tank Appurtenances:
    a. Anode Rod: Replaceable magnesium.
    b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
    c. Drain Valve: Corrosion-resistant metal with hose-end connection.
    d. Insulation: Comply with ASHRAE/IES 90.1.
    e. Jacket: Steel with enameled finish.
    f. Heat-Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.
    g. Burner: For use with power-vent, gas-fired, domestic-water heaters and natural-gas fuel.
    h. Ignition: Standing pilot or ANSI Z21.20/CSA C22.2 No. 60730-2-5, electric, automatic, gas-ignition system.
    i. Temperature Control: Adjustable thermostat.
    j. Combination Temperature-and-Pressure Relief Valve: ANSI Z21.22/CSA 4.4. Include relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select relief valve with sensing element that extends into storage tank.
5. Power-Vent System: Exhaust fan, interlocked with burner.

2.6 COMMERCIAL, GAS- AND OIL-FIRED, DOMESTIC-WATER HEATERS

A. Description: Comply with ANSI Z21.10.3/CSA 4.3 or UL 732 requirements appropriate for dual-fuel, gas- and oil-fired, domestic-water heaters.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. A. O. Smith Corporation.
2. Precision Boilers.
3. PVI; A WATTS Brand.
4. State Industries.

C. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.

D. Storage-Tank Construction: ASME-code steel with 150-psig minimum working-pressure rating.

1. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.
    a. NPS 2 and Smaller: Threaded ends in accordance with ASME B1.20.1.
    b. NPS 2-1/2 and Larger: Flanged ends in accordance with ASME B16.5 for steel and stainless steel flanges and in accordance with ASME B16.24 for copper and copper-alloy flanges.

E. Factory-Installed, Storage-Tank Appurtenances:

1. Anode Rod: Replaceable magnesium.
2. Dip Tube: Required unless cold-water inlet is near bottom of tank.
3. Drain Valve: Corrosion-resistant metal with hose-end connection.
4. Insulation: Comply with ASHRAE/IES 90.1.

5. Jacket: Steel with enameled finish.
6. Temperature Control: Adjustable thermostat.
7. Relief Valves: ASME rated and stamped for combination temperature-and-pressure relief valves. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select one relief valve with sensing element that extends into storage tank.

F. Fuel Burner:

1. Standards: Combination gas-and-oil burner assembly, complying with appropriate requirements of UL 795; or comply with UL 296 for oil burners for No. 2 fuel oil and UL 795 for natural-gas fuel.
2. Safety Control: Automatic, high-temperature-limit cutoff device or system.
3. Vent Connection: In accordance with standards of authorities having jurisdiction for dual-fuel, domestic-water heaters.

2.7 DOMESTIC-WATER HEATER ACCESSORIES

A. Domestic-Water Expansion Tanks:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. A. O. Smith Corporation.
   b. AMTROL, Inc.
   c. State Industries.
   d. TACO Comfort Solutions, Inc.
2. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
3. Description: Steel, pressure-rated tank constructed with welded joints and factory-installed, butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
4. Construction:
   a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
   b. Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
   c. Air-Charging Valve: Factory installed.
5. Capacity and Characteristics:
   a. Working-Pressure Rating: 150 psig.
   b. Capacity Acceptable: 2 gal. minimum.
   c. Air Precharge Pressure: 20 psig.

B. Drain Pans: Corrosion-resistant metal with raised edge. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than NPS 3/4 with ASME B1.20.1 pipe threads.

C. Piping-Type Heat Traps: Field-fabricated piping arrangement in accordance with ASHRAE/IES 90.1.

D. Heat-Trap Fittings: ASHRAE 90.2.

E. Comply with requirements for ball-, butterfly-, or gate-type shutoff valves specified in Section 22 05 23.12 "Ball Valves for Plumbing Piping," Section 22 05 23.13 "Butterfly Valves for Plumbing Piping," and Section 22 05 23.15 "Gate Valves for Plumbing Piping."

1. Comply with requirements for balancing valves specified in Section 22 11 19 "Domestic Water Piping Specialties."

F. Gas Shutoff Valves: ANSI Z21.15/CSA 9.1, manually operated. Furnish for installation in piping.

G. Gas Pressure Regulators: ANSI Z21.18/CSA 6.3, appliance type. Include 1/2-psig pressure rating as required to match gas supply.

H. Automatic Gas Valves: ANSI Z21.21/CSA 6.5, appliance, electrically operated, on-off automatic valve.

I. Combination Temperature-and-Pressure Relief Valves: Include relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select relief valves with sensing element that extends into storage tank.

1. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4.

2. Oil-Fired, Domestic-Water Heaters: ASME rated and stamped.

J. Pressure Relief Valves: Include pressure setting less than working-pressure rating of domestic-water heater.

1. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4.

2. Oil-Fired, Domestic-Water Heaters: ASME rated and stamped.

K. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4.

L. Domestic-Water Heater Stands: Manufacturer's factory-fabricated steel stand for floor mounting, capable of supporting domestic-water heater and water. Provide dimension that will support bottom of domestic-water heater minimum of 18 inches above the floor.

M. Domestic-Water Heater Mounting Brackets: Manufacturer's factory-fabricated steel bracket for wall mounting, capable of supporting domestic-water heater and water.

2.8 SOURCE QUALITY CONTROL

A. Factory Tests: Test and inspect assembled domestic-water heaters and storage tanks specified to be ASME-code construction, in accordance with ASME Boiler and Pressure Vessel Code.

B. Hydrostatically test commercial domestic-water heaters and storage tanks to minimum of one and one-half times pressure rating before shipment.

C. Domestic-water heaters will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 DOMESTIC-WATER HEATER INSTALLATION

A. Commercial, Domestic-Water Heater Mounting: Install commercial domestic-water heaters on concrete base. Comply with requirements for concrete base specified in Section 03 30 00 "Cast-in-Place Concrete."

1. Exception: Omit concrete bases for commercial domestic-water heaters if installation on stand, bracket, suspended platform, or directly on floor is indicated.

2. Maintain manufacturer's recommended clearances.

3. Arrange units so controls and devices that require servicing are accessible.

4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.

5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.

6. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

7. Install anchor bolts to elevations required for proper attachment to supported equipment.

8. Anchor domestic-water heaters to substrate.

B. Residential, Domestic-Water Heater Mounting: Install residential domestic-water heaters on water-heater stand on floor or domestic-water heater mounting bracket.

1. Maintain manufacturer's recommended clearances.

2. Arrange units so controls and devices that require servicing are accessible.

3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

4. Install anchor bolts to elevations required for proper attachment to supported equipment.
5. Anchor domestic-water heaters to substrate.

C. Tankless, Domestic-Water Heater Mounting: Install tankless, domestic-water heaters at least 18 inches above floor on wall bracket.

1. Maintain manufacturer's recommended clearances.
2. Arrange units so controls and devices that require servicing are accessible.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to supported equipment.
5. Anchor domestic-water heaters to substrate.

D. Install domestic-water heaters level and plumb, in accordance with layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section 22 05 23.12 "Ball Valves for Plumbing Piping," Section 22 05 23.13 "Butterfly Valves for Plumbing Piping," and Section 22 05 23.15 "Gate Valves for Plumbing Piping."

E. Install gas-fired, domestic-water heaters in accordance with NFPA 54.

1. Install gas shutoff valves on gas supply piping to gas-fired, domestic-water heaters without shutoff valves.
2. Install gas pressure regulators on gas supplies to gas-fired, domestic-water heaters without gas pressure regulators if gas pressure regulators are required to reduce gas pressure at burner.
3. Install automatic gas valves on gas supplies to gas-fired, domestic-water heaters if required for operation of safety control.
4. Comply with requirements for gas shutoff valves, gas pressure regulators, and automatic gas valves specified in Section 23 11 23 "Facility Natural-Gas Piping."

F. Install oil-fired, domestic-water heaters in accordance with NFPA 31.

1. Install shutoff valves on fuel-oil supply piping to oil-fired water-heater burners without shutoff valves. Comply with requirements for shutoff valves specified in Section 23 11 13 "Facility Fuel-Oil Piping."

G. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend domestic-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

H. Install combination temperature-and-pressure relief valves in water piping for domestic-water heaters without storage. Extend domestic-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

I. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Section 22 11 19 "Domestic Water Piping Specialties."

J. Install thermometer on outlet piping of domestic-water heaters. Comply with requirements for thermometers specified in Section 22 05 19 "Meters and Gages for Plumbing Piping."

K. Assemble and install inlet and outlet piping manifold kits for multiple domestic-water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each domestic-water heater. Include shutoff valve and thermometer in each domestic-water heater inlet and outlet, and throttling valve in each domestic-water heater outlet. Comply with requirements for valves specified in Section 22 05 23.12 "Ball Valves for Plumbing Piping," Section 22 05 23.13 "Butterfly Valves for Plumbing Piping," and Section 22 05 23.15 "Gate Valves for Plumbing

Piping," and comply with requirements for thermometers specified in Section 22 05 19 "Meters and Gages for Plumbing Piping."

L. Install piping-type heat traps on inlet and outlet piping of domestic-water heater storage tanks without integral or fitting-type heat traps.

M. Fill domestic-water heaters with water.

N. Charge domestic-water expansion tanks with air to required system pressure.

O. Install dielectric fittings in all locations where piping of dissimilar metals is to be joined. The wetted surface of the dielectric fitting contacted by potable water shall contain less than 0.25 percent of lead by weight.

3.2 PIPING CONNECTIONS

A. Comply with requirements for domestic-water piping specified in Section 22 11 16 "Domestic Water Piping."

B. Comply with requirements for fuel-oil piping specified in Section 23 11 13 "Facility Fuel-Oil Piping."

C. Comply with requirements for gas piping specified in Section 23 11 23 "Facility Natural-Gas Piping."

D. Drawings indicate general arrangement of piping, fittings, and specialties.

E. Where installing piping adjacent to fuel-fired, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.3 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

2. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.

3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Domestic-water heaters will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.5 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain commercial, gas-fired, storage, gas-fired, tankless commercial, gas- and oil-fired, domestic-water heaters. Training shall be a minimum of one hour(s).

END OF SECTION

SECTION 23 05 10 - BASIC MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this and the other sections of Division 23.

1.2 SUMMARY

A. This Section includes general administrative and procedural requirements for mechanical installations. The following administrative and procedural requirements are included in this Section to expand the requirements specified in Division 1:

1. Submittals.
2. Coordination drawings.
3. Record documents.
4. Maintenance manuals.
5. Rough-ins.
6. Mechanical installations.
7. Cutting and patching.

B. Related Sections: The following sections contain requirements that relate to this section:

1. Division 23 Section "BASIC MECHANICAL MATERIALS AND METHODS," for materials and methods common to the remainder of Division 23, plus general related specifications including:

a. Access to mechanical installations.

1.3 SUBMITTALS

A. General: Follow the procedures specified in Division 1 Section "SUBMITTALS."

B. Increase, by the quantity listed below, the number of mechanical related shop drawings, product data, and samples submitted, to allow for required distribution plus two copies of each submittal required, which will be retained by the Mechanical Consulting Engineer.

1. Shop Drawings - Initial Submittal: 1 additional blue- or black-line prints.
2. Shop Drawings - Final Submittal: 1 additional blue- or black-line prints.
3. Product Data: 1 additional copy of each item.
4. Samples: 1 addition as set.

C. Additional copies may be required by individual sections of these Specifications.

1.4 RECORD DOCUMENTS

A. Prepare record documents in accordance with the requirements in Division 1 Section "PROJECT CLOSEOUT." In addition to the requirements specified in Division 1, indicate the following installed conditions:

1. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
2. Approved substitutions, Contract Modifications, and actual equipment and materials installed.
3. Contract Modifications, actual equipment and materials installed.

1.5 MAINTENANCE MANUALS

A. Prepare maintenance manuals in accordance with Division 1 Section "PROJECT CLOSEOUT." In addition to the requirements specified in Division 1, include the following information for equipment items:

1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
2. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.

3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
4. Servicing instructions and lubrication charts and schedules.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

1.7 WARRANTIES

A. Warranties shall begin at date of final completion. All compressors shall include a minimum of five years warranty. One year warranty for labor, parts, units, etc. is required for all equipment. Additionally, Contractor is responsible for all preventative maintenance and routine service on installed equipment for the one year warranty period in order to maintain all factory/manufacturer warranties.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 ROUGH-IN

A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

3.2 MECHANICAL INSTALLATIONS

A. General: Sequence, coordinate, and integrate the various elements of mechanical systems, materials, and equipment. Comply with the following requirements:
1. Coordinate mechanical systems, equipment, and materials installation with other building components.
2. Verify all dimensions by field measurements.
3. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
4. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
5. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
6. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
7. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect.
8. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
9. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.
10. Install access panel or doors where units are concealed behind finished surfaces. Access panels and doors are specified in Division 8 Section "ACCESS DOORS" and Division 23 Section "BASIC MECHANICAL MATERIALS AND METHODS."
11. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

3.3 CUTTING AND PATCHING

A. General: Perform cutting and patching in accordance with Division 1 Section "CUTTING AND PATCHING." In addition to the requirements specified in Division 1, the following requirements apply:
   1. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.

B. Perform cutting, fitting, and patching of mechanical equipment and materials required to:
   1. Uncover Work to provide for installation of ill-timed Work.
   2. Remove and replace defective Work.
   3. Remove and replace Work not conforming to requirements of the Contract Documents.
   4. Remove samples of installed Work as specified for testing.
   5. Install equipment and materials in existing structures.
   6. Upon written instructions from the Architect, uncover and restore Work to provide for Architect/Engineer observation of concealed Work.

C. Cut, remove and legally dispose of selected mechanical equipment, components, and materials as indicated, including but not limited to removal of mechanical piping, heating units, plumbing fixtures and trim, and other mechanical items made obsolete by the new Work.

D. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

E. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.
   1. Patch existing finished surfaces and building components using new materials matching existing materials and experienced Installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched.
   2. Patch finished surfaces and building components using new materials specified for the original installation and experienced Installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched.

END OF SECTION

SECTION 23 05 11 - BASIC MECHANICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and the Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following basic mechanical materials and methods to complement other Division 23 Sections.

1. Piping materials and installation instructions common to most piping systems.
2. Concrete equipment base construction requirements.
3. Equipment nameplate data requirements.
4. Labeling and identifying mechanical systems and equipment is specified in Division 23.
5. Nonshrink grout for equipment installations.
6. Field-fabricated metal and wood equipment supports.
7. Installation requirements common to equipment specification Sections.
8. Mechanical demolition.
9. Cutting and patching.
10. Touchup painting and finishing.

1.3 DEFINITIONS

A. Pipe, pipe fittings, and piping include tube, tube fittings, and tubing.

B. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below the roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.

C. Exposed Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

D. Exposed Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

E. Concealed Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

F. Concealed Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants, but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end-caps. Maintain end-caps through shipping, storage, and handling to prevent pipe-end damage and prevent entrance of dirt, debris, and moisture.

B. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. When stored inside, do not exceed structural capacity of the floor.

C. Protect flanges, fittings, and piping specialties from moisture and dirt.

1.5 SEQUENCING AND SCHEDULING

A. Coordinate mechanical equipment installation with other building components.

B. Coordinate the installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning prior to closing in the building.

D. Coordinate connection of electrical services.

E. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and

controlling agencies.

F. Coordinate installation of identifying devices after completing covering and painting where devices are applied to surfaces. Install identifying devices prior to installing acoustical ceilings and similar concealment.

1.6 WARRANTIES

A. Warranties shall begin at date of substantial completion. All compressors shall include a minimum of five years warranty. One year warranty for labor, parts, units, etc. is required for all equipment. Additionally, Contractor is responsible for all preventative maintenance and routine service on installed equipment for the one year warranty period in order to maintain all factory/manufacturer warranties.

PART 2 - PRODUCTS

2.1 PIPE AND PIPE FITTINGS

A. Refer to individual piping system specification Sections for pipe and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.2 JOINING MATERIALS

A. Refer to individual piping system specification Sections in Division 23 for special joining materials not listed below.

B. Solder Filler Metal: ASTM B 32.

1. Alloy Sn95 or Alloy Sn94: Tin (approximately 95 percent) and silver (approximately 5 percent), having 0.10 percent lead content.
2. Alloy E: Tin (approximately 95 percent) and copper (approximately 5 percent), having 0.10 percent maximum lead content.
3. Alloy HA: Tin-antimony-silver-copper-zinc, having 0.10 percent maximum lead content.
4. Alloy HB: Tin-antimony-silver-copper-nickel, having 0.10 percent maximum lead content.

C. Brazing Filler Metals: AWS A5.8.

1. BCuP Series: Copper-phosphorus alloys.
2. BAg1: Silver alloy.

D. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

E. Solvent Cements: Manufacturer's standard solvents complying with the following:

1. Chlorinated Poly(Vinyl Chloride) (CPVC): ASTM F 493.
2. Poly(Vinyl Chloride) (PVC): ASTM D 2564.

F. Plastic Pipe Seals: ASTM F 477, elastomeric gasket.

G. Couplings: Iron body sleeve assembly, fabricated to match outside diameters of plain-end pressure pipes.

1. Sleeve: ASTM A 126, Class B, gray iron.
2. Followers: ASTM A 47 (ASTM A 47M), Grade 32510 or ASTM A 536 ductile iron.
3. Gaskets: Rubber.
4. Bolts and Nuts: AWWA C111.
5. Finish: Enamel paint.

2.3 IDENTIFYING DEVICES AND LABELS

A. General: Manufacturer's standard products of categories and types required for each application as referenced in other Division 23 Sections. Where more than one type is specified for listed application, selection is Installer's option, but provide single selection for each product category.

B. Equipment Nameplates: Metal nameplate with operational data engraved or stamped, permanently fastened to equipment.

1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power

characteristics, labels of tested compliances, and similar essential data.

2. Location: An accessible and visible location.

C. Stencils: Standard stencils, prepared for required applications with letter sizes conforming to recommendations of ASME A13.1 for piping and similar applications, but not less than 1-1/4-inch (30mm) -high letters for ductwork and not less than 3/4-inch (19mm) -high letters for access door signs and similar operational instructions.

1. Material: Brass.
2. Stencil Paint: Standard exterior type stenciling enamel; black, except as otherwise indicated; either brushing grade or pressurized spray-can form and grade.
3. Identification Paint: Standard identification enamel of colors indicated or, if not otherwise indicated for piping systems, comply with ASME A13.1 for colors.

D. Lettering and Graphics: Coordinate names, abbreviations, and other designations used in mechanical identification, with corresponding designations indicated. Use numbers, lettering, and wording indicated for proper identification and operation/maintenance of mechanical systems and equipment.

2.4 GROUT

A. Nonshrink, Nonmetallic Grout: ASTM C 1107, Grade B.

1. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi (34.50MPa), 28-day compressive strength.
3. Packaging: Premixed and factory-packaged.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS--COMMON REQUIREMENTS

A. General: Install piping as described below, except where system Sections specify otherwise. Individual piping system specification Sections in Division 23 specify piping installation requirements unique to the piping system.

B. General Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated, except where deviations to layout are approved on coordination drawings.

C. Install components having pressure rating equal to or greater than system operating pressure.

D. Install piping in concealed interior and exterior locations, except in equipment rooms and service areas.

E. Install piping free of sags and bends.

F. Install exposed interior and exterior piping at right angles or parallel to building walls. Diagonal runs are prohibited, except where indicated.

G. Install piping tight to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.

H. Install piping to allow application of insulation plus 1-inch (25mm) clearance around insulation.

I. Locate groups of pipes parallel to each other, spaced to permit valve servicing.

J. Install fittings for changes in direction and branch connections.

K. Install couplings according to manufacturer's printed instructions.

L. Sleeves are not required for core drilled holes.

M. Permanent sleeves are not required for holes formed by PE plastic (removable) sleeves.

N. Install sleeves for pipes passing through concrete and masonry walls, concrete floor and roof slabs, and where indicated.

1. Cut sleeves to length for mounting flush with both surfaces.
   a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level. Extend cast-iron sleeve fittings below

floor slab as required to secure clamping ring where specified.

2. Install large enough sleeves to provide 1/4-inch (6mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
   a. Steel Pipe Sleeves: For pipes smaller than 6 inches (150 mm).
3. Except for below-grade wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using elastomeric joint sealants specified in Division 7 Section "Joint Sealants."

O. Above Grade, Exterior Wall, Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeve for 1-inch (25mm) annular clear space between pipe and sleeve for installation of mechanical seals.
   1. Install steel pipe for sleeves smaller than 6 inches (150 mm).
   2. Install cast-iron wall pipes for sleeves 6 inches (150 mm) and larger.
   3. Assemble and install mechanical seals according to manufacturer's printed instructions.

P. Below Grade, Exterior Wall, Pipe Penetrations: Install ductile-iron wall penetration system sleeves according to manufacturer's printed installation instructions.

Q. Fire Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestopping sealant material. Firestopping materials are specified in Division 7 Section "Firestopping."

R. Verify final equipment locations for roughing in.

S. Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping system Sections.
   1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
   2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
   3. Soldered Joints: Construct joints according to AWS "Soldering Manual," Chapter 22 "The Soldering of Pipe and Tube."
   4. Brazed Joints: Construct joints according to AWS "Brazing Manual" in the "Pipe and Tube" chapter.
   5. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full inside diameter. Join pipe fittings and valves as follows:
      a. Note the internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
      b. Apply appropriate tape or thread compound to external pipe threads (except where dry seal threading is specified).
      c. Align threads at point of assembly.
      d. Tighten joint with wrench. Apply wrench to valve end into which pipe is being threaded.
      e. Damaged Threads: Do not use pipe or pipe fittings having threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

T. Piping Connections: Except as otherwise indicated, make piping connections as specified below.
   1. Install unions in piping 2 inches (50 mm) and smaller adjacent to each valve and at final connection to each piece of equipment having a 2-inch (50mm) or smaller threaded pipe connection.
   2. Wet Piping Systems (Water and Steam): Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.2 EQUIPMENT INSTALLATION--COMMON REQUIREMENTS

A. Install equipment to provide the maximum possible headroom where mounting heights are not indicated.

B. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to the Architect.

C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, except where otherwise indicated.

D. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. Connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.

E. Install equipment giving right-of-way to piping systems installed at a required slope.

3.3 LABELING AND IDENTIFYING

A. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.

1. Stenciled Markers: Complying with ASME A13.1.

B. Equipment: Install engraved plastic laminate sign or equipment marker on or near each major item of mechanical equipment.

1. Lettering Size: Minimum 1/4-inch (6mm) -high lettering for name of unit where viewing distance is less than 2 feet (0.6 m), 1/2-inch (13mm) -high for distances up to 6 feet (1.8 m), and proportionately larger lettering for greater distances. Provide secondary lettering 2/3 to 3/4 of size of principal lettering.

2. Text of Signs: Provide text to distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to name of identified unit.

C. Adjusting: Relocate identifying devices which become visually blocked by work of this Division or other Divisions.

3.4 PAINTING AND FINISHING

A. Damage and Touch Up: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.5 DEMOLITION

A. Disconnect, demolish, and remove work specified under Division 23 and as indicated.

B. Where pipe, ductwork, insulation, or equipment to remain is damaged or disturbed, remove damaged portions and install new products of equal capacity and quality.

C. Accessible Work: Remove indicated exposed pipe and ductwork in its entirety.

D. Abandoned Work: Cut and remove buried pipe abandoned in place, 2 inches (50 mm) beyond the face of adjacent construction. Cap and patch surface to match existing finish.

E. Removal: Remove indicated equipment from the Project site.

F. Temporary Disconnection: Remove, store, clean, reinstall, reconnect, and make operational equipment indicated for relocation.

3.6 CUTTING AND PATCHING

A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of the trades involved.

B. Repair cut surfaces to match adjacent surfaces.

3.7 GROUTING

A. Install nonmetallic nonshrink grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's printed instructions.

B. Clean surfaces that will come into contact with grout.

C. Provide forms for placement of grout, as required.

D. Avoid air entrapment when placing grout.

E. Place grout to completely fill equipment bases.

F. Place grout on concrete bases to provide a smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout according to manufacturer's printed instructions.

END OF SECTION

SECTION 23 05 13 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on alternating-current power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with NEMA MG 1 unless otherwise indicated.

B. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Premium efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.

E. Multispeed Motors: Separate winding for each speed.

F. Rotor: Random-wound, squirrel cage.

G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

H. Temperature Rise: Match insulation rating.

I. Insulation: Class F.

J. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
2. Motors Smaller Than 15 HP: Manufacturer's standard starting characteristic.

K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 ADDITIONAL REQUIREMENTS FOR POLYPHASE MOTORS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable-Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width-modulated inverters.
2. Premium-Efficient Motors: Class B temperature rise; Class F insulation.
3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 23 05 17 - SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Sleeves.
2. Stack-sleeve fittings.
3. Sleeve-seal systems.
4. Sleeve-seal fittings.
5. Grout.
6. Silicone sealants.

B. Related Requirements:

1. Section 07 84 13 "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1. Product Data: For sealants, indicating VOC content.
2. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Cast-Iron Pipe Sleeves: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop collar.

B. Steel Pipe Sleeves: ASTM A53/A53M, Type E, Grade B, Schedule 40, anti-corrosion coated or zinc coated, with plain ends and integral welded waterstop collar.

C. Galvanized-Steel Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

D. PVC Pipe Sleeves: ASTM D1785, Schedule 40.

E. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

F. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

2.2 STACK-SLEEVE FITTINGS

A. Description: Manufactured, Dura-coated or Duco-coated galvanized cast-iron sleeve with integral cast flashing flange for use in waterproof floors and roofs. Include clamping ring, bolts, and nuts for membrane flashing.

2.3 SLEEVE-SEAL SYSTEMS

A. Description:

1. Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
2. Designed to form a hydrostatic seal of 20-psig.

3. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size.
4. Pressure Plates: Carbon steel.
5. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, ASTM B633 of length required to secure pressure plates to sealing elements.

2.4 SLEEVE-SEAL FITTINGS

A. Description:
1. Manufactured plastic, sleeve-type, waterstop assembly, made for imbedding in concrete slab or wall.
2. Plastic or rubber waterstop collar with center opening to match piping OD.

2.5 GROUT

A. Description: Nonshrink, recommended for interior and exterior sealing openings in nonfire-rated walls or floors.
B. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
C. Design Mix: 5000-psi, 28-day compressive strength.
D. Packaging: Premixed and factory packaged.

2.6 SILICONE SEALANTS

A. Silicone, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant, ASTM C920, Type S, Grade NS, Class 25, use NT.
1. Verify sealant has a VOC content of 250 g/L or less.
2. Verify sealant complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
B. Silicone, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade P, Class 25, Uses T and NT. Grade P Pourable (self-leveling) formulation is for opening in floors and other horizontal surfaces that are not fire rated.
1. Verify sealant has a VOC content of 250 g/L or less.
2. Verify sealant complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
C. Silicone Foam: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.
1. Verify sealant has a VOC content of 250 g/L or less.
2. Verify sealant complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
1. Sleeves are not required for core-drilled holes.
C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
2. Cut sleeves to length for mounting flush with both surfaces.
    a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
3. Using grout or silicone sealant, seal space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.
1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use sealants appropriate for size, depth, and location of joint.

E. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke-Barrier Penetrations: Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping and fill materials specified in Section 07 84 13 "Penetration Firestopping."

3.2 STACK-SLEEVE-FITTING INSTALLATION

A. Install stack-sleeve fittings in new slabs as slabs are constructed.
1. Install fittings that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section 07 62 00 "Sheet Metal Flashing and Trim."
3. Install section of cast-iron soil pipe to extend sleeve to 3 inches above finished floor level.
4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
5. Using waterproof silicone sealant, seal space between top hub of stack-sleeve fitting and pipe.

B. Fire-Resistance-Rated, Horizontal Assembly, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping specified in Section 07 84 13 "Penetration Firestopping."

3.3 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal-system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.4 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings as new walls and slabs are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout or silicone sealant, seal space around outside of sleeve-seal fittings.

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Leak Test: After allowing for a full cure, test sleeves and sleeve seals for leaks. Repair leaks and retest until no leaks exist.

B. Sleeves and sleeve seals will be considered defective if they do not pass tests and inspections.

3.6 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls Above Grade:
   a. Piping Smaller Than NPS 6: Cast-iron sleeves Sleeve-seal fittings.
   b. Piping NPS 6 and Larger: Cast-iron pipe sleeves Sleeve-seal fittings.
2. Exterior Concrete Walls Below Grade:
   a. Piping Smaller Than NPS 6: Cast-iron pipe sleeves with sleeve-seal system Sleeve-seal fittings.
      1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
   b. Piping NPS 6 and Larger: Cast-iron pipe sleeves with sleeve-seal system, Steel pipe sleeves with sleeve-seal system, Sleeve-seal fittings.
      1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
3. Concrete Slabs-on-Grade:
   a. Piping Smaller Than NPS 6: Cast-iron pipe sleeves with sleeve-seal system, Steel pipe sleeves with sleeve-seal system, Sleeve-seal fittings.
      1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
   b. Piping NPS 6 and Larger: Cast-iron pipe sleeves with sleeve-seal system, Steel pipe sleeves with sleeve-seal system, Sleeve-seal fittings.
      1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
4. Concrete Slabs Above Grade:
   a. Piping Smaller Than NPS 6: Steel pipe sleeves, Molded-PE or -PP sleeves, or Molded-PVC sleeves.
   b. Piping NPS 6 and Larger: Steel pipe sleeves, PVC-pipe sleeves, Stack-sleeve fittings.
5. Interior Partitions:
   a. Piping Smaller Than NPS 6: Steel pipe sleeves.
   b. Piping NPS 6 and Larger: Galvanized-steel sheet sleeves.

END OF SECTION

SECTION 23 05 18 - ESCUTCHEONS FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Escutcheons.
2. Floor plates.

1.3 DEFINITIONS

A. Existing Piping to Remain: Existing piping that is not to be removed and that is not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

A. One-Piece, Steel Type: With polished, chrome-plated finish and setscrew fastener.

B. One-Piece, Stainless-Steel Type: With polished stainless-steel finish.

C. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.

D. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped steel with polished, chrome-plated finish and spring-clip fasteners.

E. One-Piece, Stamped-Steel Type: With polished, chrome-plated finish and spring-clip fasteners.

F. Split-Plate, Stamped-Steel Type: With polished, chrome-plated finish; concealed and exposed-rivet hinge; and spring-clip fasteners.

2.2 FLOOR PLATES

A. Split Floor Plates: Steel with concealed hinge.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. Escutcheons for New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep pattern.

b. Chrome-Plated Piping: One-piece steel, cast brass or split-plate steel with polished, chrome-plated finish.

c. Insulated Piping: One-piece steel with polished, chrome-plated finish.

d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece steel with polished, chrome-plated finish.

e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece steel with polished, chrome-plated finish.

f. Bare Piping in Unfinished Service Spaces: One-piece steel with polished, chrome-plated finish.

g. Bare Piping in Equipment Rooms: One-piece steel with polished, chrome-plated finish.

h. Chrome-Plated Piping: Split-plate, stamped steel with concealed or exposed-rivet hinge with polished, chrome-plated finish.

i. Insulated Piping: Split-plate, stamped steel with concealed or exposed-rivet hinge with polished, chrome-plated finish.

j. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate, stamped steel with concealed or exposed-rivet hinge with polished, chrome-plated finish.

k. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped steel with concealed or exposed-rivet hinge with polished, chrome-plated finish.

l. Bare Piping in Unfinished Service Spaces: Split-plate, stamped steel with concealed or exposed-rivet hinge with polished, chrome-plated finish.

m. Bare Piping in Equipment Rooms: Split-plate, stamped steel with concealed or exposed-rivet hinge with polished, chrome-plated finish.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. New Piping: Split floor plate.

2. Existing Piping to Remain: Split floor plate.

3.2 FIELD QUALITY CONTROL

A. Using new materials, replace broken and damaged escutcheons and floor plates.

END OF SECTION

SECTION 23 05 19 - METERS AND GAGES FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Bimetallic-actuated thermometers.
2. Filled-system thermometers.
3. Liquid-in-glass thermometers.
4. Duct-thermometer mounting brackets.
5. Thermowells.
6. Dial-type pressure gages.
7. Gage attachments.
8. Test plugs.
9. Test-plug kits.
10. Sight flow indicators.
11. Flowmeters.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of meter and gage.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 BIMETALLIC-ACTUATED THERMOMETERS

A. Standard: ASME B40.200.

B. Case: Liquid-filled and sealed type(s); stainless steel with 3-inch nominal diameter.

C. Dial: Nonreflective aluminum with permanently etched scale markings and scales in deg F.

D. Connector Type(s): Union joint, adjustable angle, with unified-inch screw threads.

E. Connector Size: 1/2 inch, with ASME B1.1 screw threads.

F. Stem: 0.25 or 0.375 inch in diameter; stainless steel.

G. Window: Plain glass or plastic.

H. Ring: Stainless steel.

I. Element: Bimetal coil.

J. Pointer: Dark-colored metal.

K. Accuracy: Plus or minus 1 percent of scale range.

2.2 FILLED-SYSTEM THERMOMETERS

A. Direct-Mounted, Metal-Case, Vapor-Actuated Thermometers:

1. Standard: ASME B40.200.
2. Case: Sealed type, cast aluminum or drawn steel; 4-1/2-inch nominal diameter.

3. Element: Bourdon tube or other type of pressure element.
4. Movement: Mechanical, dampening type, with link to pressure element and connection to pointer.
5. Dial: Nonreflective aluminum with permanently etched scale markings graduated in deg F.
6. Pointer: Dark-colored metal.
7. Window: Glass or plastic.
8. Ring: Stainless steel.
9. Connector Type(s): Union joint, adjustable, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device; with ASME B1.1 screw threads.
10. Thermal System: Liquid-filled bulb in copper-plated steel, aluminum, or brass stem and of length to suit installation.
    a. Design for Air-Duct Installation: With ventilated shroud.
    b. Design for Thermowell Installation: Bare stem.
11. Accuracy: Plus or minus 1 percent of scale range.

2.3 LIQUID-IN-GLASS THERMOMETERS

A. Metal-Case, Compact-Style, Liquid-in-Glass Thermometers:
1. Standard: ASME B40.200.
2. Case: Cast aluminum; 6-inch nominal size.
3. Case Form: Straight unless otherwise indicated.
4. Tube: Glass with magnifying lens and blue or red organic liquid.
5. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F.
6. Window: Glass or plastic.
7. Stem: Aluminum or brass and of length to suit installation.
    a. Design for Air-Duct Installation: With ventilated shroud.
    b. Design for Thermowell Installation: Bare stem.
8. Connector: 3/4 inch, with ASME B1.1 screw threads.
9. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

2.4 DUCT-THERMOMETER MOUNTING BRACKETS

A. Description: Flanged bracket with screw holes, for attachment to air duct and made to hold thermometer stem.

2.5 THERMOWELLS

A. Thermowells:
1. Standard: ASME B40.200.
2. Description: Pressure-tight, socket-type fitting made for insertion in piping tee fitting.
3. Material for Use with Copper Tubing: CNR or CUNI.
4. Material for Use with Steel Piping: CRES.
5. Type: Stepped shank unless straight or tapered shank is indicated.
6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.
7. Internal Threads: 1/2, 3/4, and 1 inch, with ASME B1.1 screw threads.
8. Bore: Diameter required to match thermometer bulb or stem.
9. Insertion Length: Length required to match thermometer bulb or stem.
10. Lagging Extension: Include on thermowells for insulated piping and tubing.
11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

B. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.6 DIAL-TYPE PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Standard: ASME B40.100.
2. Case: Liquid-filled type(s); cast aluminum or drawn steel; 4-1/2-inch nominal diameter.
3. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
4. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
5. Movement: Mechanical, with link to pressure element and connection to pointer.
6. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
7. Pointer: Dark-colored metal.
8. Window: Glass or plastic.
9. Ring: Metal Stainless steel.
10. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

2.7 GAGE ATTACHMENTS

A. Snubbers: ASME B40.100, brass; with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and piston-type surge-dampening device. Include extension for use on insulated piping.

B. Siphons: Loop-shaped section of brass pipe with NPS 1/4 or NPS 1/2 pipe threads.

C. Valves: Brass or stainless-steel needle, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads.

2.8 TEST PLUGS

A. Description: Test-station fitting made for insertion in piping tee fitting.

B. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.

C. Thread Size: NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe thread.

D. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.

E. Core Inserts: Chlorosulfonated polyethylene synthetic and EPDM self-sealing rubber.

2.9 SIGHT FLOW INDICATORS

A. Description: Piping inline-installation device for visual verification of flow.

B. Construction: Bronze or stainless-steel body, with sight glass and ball, flapper, or paddle wheel indicator, and threaded or flanged ends.

C. Minimum Pressure Rating: 125 psig.

D. Minimum Temperature Rating: 200 deg F.

E. End Connections for NPS 2 and Smaller: Threaded.

F. End Connections for NPS 2-1/2 and Larger: Flanged.

2.10 FLOWMETERS

A. Orifice Flowmeters:

1. Description: Flowmeter with sensor, hoses or tubing, fittings, valves, indicator, and conversion chart.
2. Flow Range: Sensor and indicator shall cover operating range of equipment or system served.
3. Sensor: Wafer-orifice-type, calibrated, flow-measuring element; for installation between pipe flanges.
    a. Design: Differential-pressure-type measurement for gas.
    b. Construction: Cast-iron body, brass valves with integral check valves and caps, and calibrated nameplate.
    c. Minimum Pressure Rating: 300 psig.
    d. Minimum Temperature Rating: 250 deg F.

4. Permanent Indicators: Meter suitable for wall or bracket mounting, calibrated for connected sensor and having 6-inch-diameter, or equivalent, dial with fittings and copper tubing for connecting to sensor.
    a. Scale: Gallons per minute.
    b. Accuracy: Plus or minus 1 percent between 20 and 80 percent of scale range.
5. Portable Indicators: Hand-held, differential-pressure type, calibrated for connected sensor and having two 12-foot hoses, with carrying case.
    a. Scale: Gallons per minute.
    b. Accuracy: Plus or minus 2 percent between 20 and 80 percent of scale range.
6. Display: Shows rate of flow, with register to indicate total volume in gallons.
7. Conversion Chart: Flow rate data compatible with sensor and indicator.
8. Operating Instructions: Include complete instructions with each flowmeter.

B. Turbine Flowmeters:
1. Description: Flowmeter with sensor and indicator.
2. Flow Range: Sensor and indicator shall cover operating range of equipment or system served.
3. Sensor: Impeller turbine; for inserting in pipe fitting or for installing in piping and measuring flow directly in gallons per minute.
    a. Design: Device or pipe fitting with inline turbine and integral direct-reading scale for gas.
    b. Construction: Bronze or stainless-steel body, with plastic turbine or impeller.
    c. Minimum Pressure Rating: 150 psig.
    d. Minimum Temperature Rating: 180 deg F.
4. Indicator: Hand-held meter; either an integral part of sensor or a separate meter.
5. Accuracy: Plus or minus 1-1/2 percent.
6. Display: Shows rate of flow, with register to indicate total volume in gallons.
7. Operating Instructions: Include complete instructions with each flowmeter.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install thermowells with socket extending one-third of pipe diameter and in vertical position in piping tees.
B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.
C. Install thermowells with extension on insulated piping.
D. Fill thermowells with heat-transfer medium.
E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.
F. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks. Use minimum tubing length.
G. Install duct-thermometer mounting brackets in walls of ducts. Attach to duct with screws.
H. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.
I. Install valve and snubber in piping for each pressure gage for fluids (except steam).
J. Install valve and syphon fitting in piping for each pressure gage for steam.
K. Install test plugs in piping tees.
L. Install flow indicators in piping systems in accessible positions for easy viewing.
M. Assemble and install connections, tubing, and accessories between flow-measuring elements and flowmeters according to manufacturer's written instructions.

N. Install flowmeter elements in accessible positions in piping systems.

O. Install wafer-orifice flowmeter elements between pipe flanges.

P. Install differential-pressure-type flowmeter elements, with at least minimum straight lengths of pipe, upstream and downstream from element according to manufacturer's written instructions.

Q. Install connection fittings in accessible locations for attachment to portable indicators.

R. Install thermometers in the following locations:

1. Inlet and outlet of each hydronic zone.
2. Inlet and outlet of each hydronic boiler.
3. Two inlets and two outlets of each chiller.
4. Inlet and outlet of each hydronic coil in air-handling units.
5. Two inlets and two outlets of each hydronic heat exchanger.
6. Inlet and outlet of each thermal-storage tank.
7. Outside-, return-, supply-, and mixed-air ducts.
8. .

S. Install pressure gages in the following locations:

1. Discharge of each pressure-reducing valve.
2. Inlet and outlet of each chiller chilled-water and condenser-water connection.
3. Suction and discharge of each pump.
4. .

3.2 CONNECTIONS

A. Install meters and gages adjacent to machines and equipment to allow space for service and maintenance of meters, gages, machines, and equipment.

B. Connect flowmeter-system elements to meters.

C. Connect flowmeter transmitters to meters.

D. Connect thermal-energy meter transmitters to meters.

3.3 ADJUSTING

A. After installation, calibrate meters according to manufacturer's written instructions.

B. Adjust faces of meters and gages to proper angle for best visibility.

3.4 THERMOMETER SCHEDULE

A. Thermometers at inlet and outlet of each hydronic zone shall be one of the following:

1. Liquid-filled Sealed, bimetallic-actuated type.
2. Direct-mounted, metal-case, vapor-actuated type.
3. Compact-style, liquid-in-glass type.
4. Test plug with chlorosulfonated polyethylene synthetic EPDM self-sealing rubber inserts.

B. Thermometers at inlets and outlets of each hydronic heat exchanger shall be one of the following:

1. Liquid-filled Sealed, bimetallic-actuated type.
2. Direct-mounted, metal-case, vapor-actuated type.
3. Compact-style, liquid-in-glass type.
4. Direct-mounted, light-activated type.
5. Test plug with chlorosulfonated polyethylene synthetic EPDM self-sealing rubber inserts.

3.5 THERMOMETER SCALE-RANGE SCHEDULE

A. Scale Range for Condenser-Water Piping: 0 to 150 deg F.

B. Scale Range for Air Ducts: Minus 40 to plus 160 deg F.

3.6 PRESSURE-GAGE SCHEDULE

A. Pressure gages at suction and discharge of each pump shall be one of the following:

1. Liquid-filled Sealed, direct-mounted, metal case.
2. Sealed, direct-mounted, plastic case.
3. Test plug with chlorosulfonated polyethylene synthetic EPDM self-sealing rubber inserts.

3.7 PRESSURE-GAGE SCALE-RANGE SCHEDULE

A. Scale Range for Condenser-Water Piping: 0 to 30 psi.

3.8 FLOWMETER SCHEDULE

A. Flowmeters for Condenser-Water Piping: Turbine type.

END OF SECTION

SECTION 23 05 29 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Fiberglass pipe hangers.
4. Metal framing systems.
5. Fiberglass strut systems.
6. Thermal-hanger shield inserts.
7. Fastener systems.
8. Pipe stands.
9. Equipment stands.
10. Equipment supports.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
2. Environmental Product Declaration (EPD): For each product.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.5 QUALITY ASSURANCE

A. Structural-Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code, Section IX.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design trapeze pipe hangers and equipment supports.

2.2 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized, hot-dip galvanized, or electro-galvanized.
3. Nonmetallic Coatings: Plastic coated, or epoxy powder-coated.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Stainless Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.

2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

C. Copper Pipe and Tube Hangers:
1. Description: MSS SP-58, Types 1 through 58, copper-plated steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-plated steel.

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.4 FIBERGLASS PIPE HANGERS

A. Clevis-Type, Fiberglass Pipe Hangers:
1. Description: Similar to MSS SP-58, Type 1, factory-fabricated steel pipe hanger except hanger is made of fiberglass or fiberglass-reinforced resin.

2.5 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:
1. Description: Shop- or field-fabricated, pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
2. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
3. Channels: Continuous slotted carbon-steel channel with inturned lips.
4. Channel Width: Selected for applicable load criteria.
5. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of galvanized steel.
7. Metallic Coating: No coating.

B. Non-MFMA Manufacturer Metal Framing Systems:
1. Description: Shop- or field-fabricated, pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
2. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
3. Channels: Continuous slotted carbon-steel channel with inturned lips.
4. Channel Width: Select for applicable load criteria.
5. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of galvanized steel.
7. Metallic Coating: No coating.

2.6 THERMAL-HANGER SHIELD INSERTS

A. Insulation-Insert Material for Cold Piping: ASTM C552, Type II cellular glass with 100-psi or ASTM C591, Type VI, Grade 1 polyisocyanurate with 125-psi minimum compressive strength and vapor barrier.

B. Insulation-Insert Material for Hot Piping: Water-repellent-treated, ASTM C533, Type I calcium silicate with 100-psi ASTM C552, Type II cellular glass with 100-psi or ASTM C591, Type VI, Grade 1 polyisocyanurate with 125-psi minimum compressive strength.

C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.7 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type anchors for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Indoor Applications: Zinc-coated or stainless steel.
2. Outdoor Applications: Stainless steel.

2.8 PIPE STANDS

A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. Compact Pipe Stand:

1. Description: Single base unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.
2. Base: Single, vulcanized rubber, molded polypropylene, or polycarbonate.
   a. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than percent.
3. Hardware: Galvanized steel or polycarbonate.
4. Accessories: Protection pads.

C. Low-Profile, Single Base, Single-Pipe Stand:

1. Description: Single base with vertical and horizontal members, and pipe support, for roof installation without membrane protection.
2. Base: Single, vulcanized rubber, molded polypropylene, or polycarbonate.
   a. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than Insert value percent.
3. Vertical Members: Two, galvanized-steel, continuous-thread 1/2-inch rods.
4. Horizontal Member: Adjustable horizontal, galvanized-steel pipe support channels.
5. Pipe Supports: Roller.
6. Hardware: Galvanized steel.
7. Accessories: Protection pads.
8. Height: 12 inches above roof.

2.9 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.10 OUTDOOR EQUIPMENT STANDS

A. Description: Individual foot supports with elevated adjustable channel cross bars and clamps/fasteners/bolts for ground or roof supported outdoor equipment components, without roof membrane penetration, in a pre-fabricated system that can be modularly-assembled on site.

B. Foot Material: Rubber or polypropylene.

C. Rails Material: Hot dip galvanized carbon steel.

D. Wind/Sliding Load Resistance: Up to 150 MPH minimum.

2.11 MATERIALS

A. Aluminum: ASTM B221.

B. Carbon Steel: ASTM A1011/A1011M.

C. Structural Steel: ASTM A36/A36M, carbon-steel plates, shapes, and bars; galvanized.

D. Stainless Steel: ASTM A240/A240M.

E. Threaded Rods: Continuously threaded. Zinc-plated or galvanized steel for indoor applications and stainless steel for outdoor applications. Mating nuts and washers of similar materials as rods.

F. Grout: ASTM C1107/C1107M, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.

2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with requirements in Section 07 84 13 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.

B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

3.2 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.

2. Field fabricate from ASTM A36/A36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled strut systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.

2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Pipe Stand Installation:

1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.

2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Section 07 72 00 "Roof Accessories" for curbs.

G. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

H. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

I. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

J. Install lateral bracing with pipe hangers and supports to prevent swaying.

K. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and

larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

L. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

M. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

N. Insulated Piping:

1. Attach clamps and spacers to piping.
    a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
4. Shield Dimensions for Pipe: Not less than the following:
    a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
    b. NPS 4: 12 inches long and 0.06 inch thick.
    c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
    d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
    e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.

4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.6 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Touchup: Comply with requirements in Section 09 91 13 "Exterior Painting" Section 09 91 23 "Interior Painting" and Section 09 96 00 "High-Performance Coatings" for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780/A780M.

3.7 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports and metal framing systems and attachments for general service applications.

F. Use stainless steel pipe hangers and fiberglass pipe hangers and fiberglass strut systems and stainless steel or corrosion-resistant attachments for hostile environment applications.

G. Use copper-plated pipe hangers and copper or stainless steel attachments for copper piping and tubing.

H. Use padded hangers for piping that is subject to scratching.

I. Use thermal-hanger shield inserts for insulated piping and tubing.

J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.

2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.

3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.

4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.

5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.

6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.

7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.

8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is unnecessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is unnecessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

K. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.

2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.
13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

N. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

O. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.

8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
    a. Horizontal (MSS Type 54): Mounted horizontally.
    b. Vertical (MSS Type 55): Mounted vertically.
    c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

P. Comply with MSS SP-58 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

Q. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

R. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION

SECTION 23 05 53 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Duct labels.
5. Stencils.
6. Valve tags.
7. Warning tags.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: Brass, 0.032-inch aluminum, 0.032-inch or anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Letter Color: Black.
3. Background Color: White.
4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
5. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
6. Fasteners: Stainless-steel rivets or self-tapping screws.
7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch Insert dimension thick, and having predrilled holes for attachment hardware.
2. Letter Color: Black.
3. Background Color: Black.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch Insert dimension thick, and having predrilled holes for attachment hardware.

B. Letter Color: Red.

C. Background Color: White.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information plus emergency notification instructions.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction according to ASME A13.1.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: Size letters according to ASME A13.1 for piping At least 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.

2.4 DUCT LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: White.

C. Background Color: Black.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings; also include duct size and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions or as separate unit on each duct label to indicate flow direction.

2.5 STENCILS

A. Stencils for Piping:

1. Lettering Size: Size letters according to ASME A13.1 for piping At least 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.

2. Stencil Material: Brass.

3. Stencil Paint: Exterior, gloss, alkyd enamel in colors complying with recommendations in ASME A13.1 unless otherwise indicated. Paint may be in pressurized spray-can form.

4. Identification Paint: Exterior, alkyd enamel in colors according to ASME A13.1 unless otherwise indicated. Paint may be in pressurized spray-can form.

B. Stencils for Ducts:

1. Lettering Size: Minimum letter height of 1-1/4 inches for viewing distances up to 15 feet and proportionately larger lettering for greater viewing distances.

2. Stencil Material: Brass.

3. Stencil Paint: Exterior, gloss, alkyd enamel. Paint may be in pressurized spray-can form.

4. Identification Paint: Exterior, alkyd enamel. Paint may be in pressurized spray-can form.

C. Stencils for Access Panels and Door Labels, Equipment Labels, and Similar Operational Instructions:

1. Lettering Size: Minimum letter height of 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.

2. Stencil Material: Brass.

3. Stencil Paint: Exterior, gloss, alkyd enamel. Paint may be in pressurized spray-can form.

4. Identification Paint: Exterior, alkyd enamel. Paint may be in pressurized spray-can form.

2.6 VALVE TAGS

A. Description: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.

1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.

2. Fasteners: Brass wire-link chain or beaded chain or S-hook.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

2.7 WARNING TAGS

A. Description: Preprinted or partially preprinted accident-prevention tags of plasticized card stock with matte finish suitable for writing.

1. Size: 3 by 5-1/4 inches minimum.
2. Fasteners: Brass grommet and wire.
3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Safety-yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

3.3 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.4 PIPE LABEL INSTALLATION

A. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, with painted, color-coded bands or rectangles on each piping system.

1. Identification Paint: Use for contrasting background.
2. Stencil Paint: Use for pipe marking.

B. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

C. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.

D. Pipe Label Color Schedule:

1. Condenser-Water Piping: White letters on a safety-green background.
2. Refrigerant Piping: Black letters on a safety-orange background.

3.5 DUCT LABEL INSTALLATION

A. Install plastic-laminated self-adhesive duct labels with permanent adhesive on air ducts in the following color codes:

1. Blue: For cold-air supply ducts.
2. Yellow: For hot-air supply ducts.

3. Green: For exhaust-, outside-, relief-, return-, and mixed-air ducts.

B. Stenciled Duct Label Option: Stenciled labels showing service and flow direction may be provided instead of plastic-laminated duct labels, at Installer's option.

C. Locate labels near points where ducts enter into and exit from concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

3.6 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, shutoff valves, faucets, convenience and lawn-watering hose connections, and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Size and Shape:

a. Condenser Water: 1-1/2 inches, round.

b. Refrigerant: 1-1/2 inches, round.

c. Hot Water: 1-1/2 inches, round.

d. Gas: 1-1/2 inches, round.

2. Valve-Tag Colors:

a. Toxic and Corrosive Fluids: Black letters on a safety-orange background.

b. Flammable Fluids: Black letters on a safety-yellow background.

c. Combustible Fluids: White letters on a safety-brown background.

d. Potable and Other Water: White letters on a safety-green background.

e. Compressed Air: White letters on a safety-blue background.

f. Defined by User: White letters on a safety-purple background, black letters on a safety-white background, white letters on a safety-gray background, and white letters on a safety-black background

3.7 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION

SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

B. Related Sections

1. General requirements for testing agencies are specified in the Division-1 Section Quality Control Services.
2. Other Division-23 Sections specify balancing devices and their installation, and materials and installations of mechanical systems.
3. Individual Division-23 system sections specify leak testing requirements and procedures.

1.2 SUMMARY

A. This Section specifies the requirements and procedures total mechanical systems testing, adjusting, and balancing. Requirements include measurement and establishment of the fluid quantities of the mechanical systems as required to meet design specifications, and recording and reporting the results.

B. Test, adjust, and balance the following mechanical systems

1. Supply air systems, all pressure ranges; including variable volume and double duct systems.
2. Return air systems.
3. Exhaust air systems.
4. Verify temperature control system operation.

C. Test systems for proper sound and vibration levels.

D. This Section does not include:

1. Testing boilers and pressure vessels for compliance with safety codes;
2. Specifications for materials for patching mechanical systems;
3. Specifications for materials and installation of adjusting and balancing devices. If devices must be added to achieve proper adjusting and balancing, refer to the respective system sections for materials and installation requirements.
4. Requirements and procedures for piping and ductwork systems leakage tests.

1.3 DEFINITIONS

A. Systems testing, adjusting, and balancing is the process of checking and adjusting all the building environmental systems to produce the design objectives. It includes:

1. The balance of air and water distribution;
2. Adjustment of total system to provide design quantities;
3. Electrical measurement;
4. Verification of performance of all equipment and automatic controls;
5. Sound and vibration measurement.

B. Test: To determine quantitative performance of equipment.

C. Adjust: To regulate the specified fluid flow rate and air patterns at the terminal equipment (e.g., reduce fan speed, throttling).

D. Balance: To proportion flows within the distribution system (submains, branches, and terminals) according to specified design quantities.

E. Procedure: Standardized approach and execution of sequence of work operations to yield reproducible results.

F. Report forms: Test data sheets arranged for collecting test data in logical order for submission and review. These data should also form the permanent record to be used as the basis for required future testing, adjusting, and balancing.

G. Terminal: The point where the controlled fluid enters or leaves the distribution system. These are supply inlets on water terminals, supply outlets on air terminals, return outlets on water terminals, and exhaust or return inlets on air terminals such as registers, grilles, diffusers, louvers, and hoods.

H. Main: Duct or pipe containing the system's major or entire fluid flow.

I. Submain: Duct or pipe containing part of the systems' capacity and serving two or more branch mains.

J. Branch main: Duct or pipe serving two or more terminals.

K. Branch: Duct or pipe serving a single terminal.

1.4 SUBMITTALS

A. Agency Data

1. Submit proof that the proposed testing, adjusting, and balancing agency meets the qualifications specified below.

B. Engineer and Technicians Data:

1. Submit proof that the Test and Balance Engineer assigned to supervise the procedures, and the technicians proposed to perform the procedures meet the qualifications specified below.

C. Procedures and Agenda: Submit a synopsis of the testing, adjusting, and balancing procedures and agenda proposed to be used for this project.

D. Maintenance Data: Submit maintenance and operating data that include how to test, adjust, and balance the building systems. Include this information in maintenance data specified in Division 1 and mechanical specifications.

E. Sample Forms: Submit sample forms, if other than those standard forms prepared by the AABC are proposed.

F. Certified Reports: Submit testing, adjusting, and balancing reports bearing the seal and signature of the Test and Balance Engineer. The reports shall be certified proof that the systems have been tested, adjusted, and balanced in accordance with the referenced standards; are an accurate representation of how the systems have been installed; are a true representation of how the systems are operating at the completion of the testing, adjusting, and balancing procedures; and are an accurate record of all final quantities measured, to establish normal operating values of the systems. Follow the procedures and format specified below:

1. Draft reports: Upon completion of testing, adjusting, and balancing procedures, prepare draft reports on the approved forms. Draft reports may be hand written, but must be complete, factual, accurate, and legible. Organize and format draft reports in the same manner specified for the final reports. Submit 2 complete sets of draft reports. Only 1 complete set of draft reports will be returned.

2. Final Report: Upon verification and approval of draft reports, prepare final reports, type written, and organized and formatted as specified below. Submit 2 complete sets of final reports.

3. Report Format: Report forms shall be those standard forms prepared by the referenced standard for each respective item and system to be tested, adjusted, and balanced. Bind report forms complete with schematic systems diagrams and other data in reinforced, vinyl, three-ring binders. Provide binding edge labels with the project identification and a title descriptive of the contents. Divide the contents of the binder into the below listed divisions, separated by divider tabs:

a. General Information and Summary

b. Air Systems

c. Hydronic Systems

d. Temperature Control Systems

e. Special Systems

f. Sound and Vibration Systems

4. Report Contents: Provide the following minimum information, forms and data:

a. General Information and Summary: Inside cover sheet to identify testing, adjusting, and balancing agency, Contractor, Owner, Architect, Engineer, and Project. Include addresses, and contact names and telephone numbers. Also include a certification sheet containing the

seal and name address, telephone number, and signature of the Certified Test and Balance Engineer. Include in this division a listing of the instrumentations used for the procedures along with the proof of calibration.

b. The remainder of the report shall contain the appropriate forms containing as a minimum, the information indicated on the standard report forms prepared by the AABC and NEBB, for each respective item and system. Prepare a schematic diagram for each item of equipment and system to accompany each respective report form.

G. Calibration Reports: Submit proof that all required instrumentation has been calibrated to tolerances specified in the referenced standards, within a period of six months prior to starting the project.

1.5 QUALITY ASSURANCE

A. PRE-QUALIFIED CONTRACTORS FOR THIS ROLE.

1. Superior Test & Balance, Inc. (AABC)
   1545 Gulf Shores Parkway, PMB #294
   Gulf Shores, AL 36542
   Tel: 251.317.3088
2. Systems Analysis, Inc. (AABC & NEBB)
   217 Oxmoor Circle
   Birmingham, AL 35209
   Tel: 205.802.7850
3. National True-Test, Inc. (NEBB)
   5757 Carrington Lake Parkway
   Trussville, AL 35173
   Tel: 205.681.9050
4. Environmental Testing Service, Inc. (NEBB)
   150 Highway 216
   Montevallo, AL 35115
   Tel: (205) 476-8640
5. Performance Testing & Balancing Co., Inc. (AABC)
   2021 Five Points Road
   Cleveland, Alabama 35049
   Tel: (205) 559-2773

B. Any Test & Balance Contractors not listed above must be requested and approved in writing ten (10) days prior to the bid.

C. Agency Qualifications

1. Employ the services of an independent testing, adjusting, and balancing agency meeting the qualifications specified below, to be the single source of responsibility to test, adjust, and balance the building mechanical systems identified above, to produce the design objectives. Services shall include checking installations for conformity to design, measurement and establishment of the fluid quantities of the mechanical systems as required to meet design specifications, and recording and reporting the results.
2. An independent testing, adjusting, and balancing agency certified by Associated Air Balance Council (AABC) in those testing and balancing disciplines required for this project, and having at least one Professional Engineer registered in the State in which the services are to be performed, certified by AABC as a Test and Balance Engineer.

D. Codes and Standards:

1. NEBB: "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems."
2. AABC: "National Standards For Total System Balance".
3. ASHRAE: ASHRAE Handbook, 1984 Systems Volume, Chapter 37, Testing, Adjusting, and Balancing.

E. Pre-Balancing Conference: Prior to beginning of the testing, adjusting, and balancing procedures, schedule and conduct a conference with the Architect/Engineer and representatives of installers of the mechanical systems. The objective of the conference is final coordination and verification of system operation and readiness for testing, adjusting, and balancing.

1.6 PROJECT CONDITIONS

A. Systems Operation: Systems shall be fully operational prior to beginning procedures.

1.7 SEQUENCING AND SCHEDULING

A. Test, adjust and balance air conditioning systems during summer season and heating systems during winter season, including at least a period of operation at outside conditions within 5 deg. F wet bulb temperature of maximum summer design condition, and within 10 deg. F dry bulb temperature of minimum winter design condition. Take final temperature readings during seasonal operation.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PRELIMINARY PROCEDURES FOR AIR SYSTEM BALANCING

A. Before operating the system, perform these steps:

1. Obtain design drawings and specifications and become thoroughly acquainted with the design intent.
2. Obtain copies of approved shop drawings of all air handling equipment, outlets (supply, return, and exhaust) and temperature control diagrams.
3. Compare design to installed equipment and field installations.
4. Walk the system from the system air handling equipment to terminal units to determine variations of installation from design.
5. Check filters for cleanliness.
6. Check dampers (both volume and fire) for correct and locked position, and temperature control for completeness of installation before starting fans.
7. Prepare report test sheets for both fans and outlets. Obtain manufacturer's outlet factors and recommended procedures for testing. Prepare a summation of required outlet volumes to permit a crosscheck with required fan volumes.
8. Determine best locations in main and branch ductwork for most accurate duct traverses.
9. Place outlet dampers in the full open position.
10. Prepare schematic diagrams of system "as-built" ductwork and piping layouts to facilitate reporting.
11. Lubricate all motors and bearings.
12. Check fan belt tension.
13. Check fan rotation.

3.2 MEASUREMENTS

A. Provide all required instrumentation to obtain proper measurements, calibrated to the tolerances specified in the referenced standards. Instruments shall be properly maintained and protected against damage.

B. Provide instruments meeting the specifications of the referenced standards.

C. Use only those instruments which have the maximum field measuring accuracy and are best suited to the function being measured.

D. Apply instrument as recommended by the manufacturer.

E. Use instruments with minimum scale and maximum subdivisions and with scale ranges proper for the value being measured.

F. When averaging values, take a sufficient quantity of readings which will result in a repeatability error of less than 5 percent. When measuring a single point, repeat readings until 2 consecutive identical values are obtained.

G. Take all reading with the eye at the level of the indicated value to prevent parallax.

H. Use pulsation dampeners where necessary to eliminate error involved in estimating average of rapidly fluctuation readings.

I. Take measurements in the system where best suited to the task.

3.3 PERFORMING TESTING, ADJUSTING, AND BALANCING

A. Perform testing and balancing procedures on each system identified, in accordance with the detailed procedures outlined in the referenced standards.

B. Cut insulation, ductwork, and piping for installation of test probes to the minimum extent necessary to allow adequate performance of procedures.

C. Patch insulation, ductwork, and housings, using materials identical to those removed.

D. Seal ducts and piping, and test for and repair leaks.

E. Seal insulation to re-establish integrity of the vapor barrier.

F. Mark equipment settings, including damper control positions, valve indicators, fan speed control levers, and similar controls and devices, to show final settings. Mark with paint or other suitable, permanent identification materials.

G. Test and Balance Contractor shall run systems through all modes of operation and report any deficiencies. Report shall include complete coil performance for all modes of operation including coil entering and leaving db/wb conditions. Report shall also include outside air temperature and humidity at time of test for each operating mode if applicable.

H. Retest, adjust, and balance systems subsequent to significant system modifications, and resubmit test results.

3.4 TESTING FOR SOUND AND VIBRATION

A. Test and adjust mechanical systems for sound and vibration in accordance with the detailed instructions of the referenced standards.

3.5 RECORD AND REPORT DATA

A. Record all data obtained during testing, adjusting, and balancing in accordance with, and on the forms recommended by the referenced standards, and as approved on the sample report forms.

B. Prepare report of recommendations for correcting unsatisfactory mechanical performances when system cannot be successfully balanced.

3.6 DEMONSTRATION

A. Training

1. Train the Owner's maintenance personnel on troubleshooting procedures and testing, adjusting, and balancing procedures. Review with the Owner's personnel, the information contained in the Operating and Maintenance Data specified in Division 1 and mechanical specifications.
2. Schedule training with Owner through the Architect/Engineer with at least 7 days prior notice.

END OF SECTION

SECTION 23 07 13 - DUCT INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes insulating the following duct services:

1. Indoor, concealed supply and outdoor air.
2. Indoor, exposed supply and outdoor air.
3. Indoor, concealed return located in unconditioned space.
4. Indoor, exposed return located in unconditioned space.
5. Indoor, concealed, Type I, commercial, kitchen hood exhaust.
6. Indoor, exposed, Type I, commercial, kitchen hood exhaust.
7. Indoor, concealed oven and warewash exhaust.
8. Indoor, exposed oven and warewash exhaust.
9. Indoor, concealed exhaust between isolation damper and penetration of building exterior.
10. Indoor, exposed exhaust between isolation damper and penetration of building exterior.
11. Outdoor, concealed supply and return.
12. Outdoor, exposed supply and return.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).

B. Sustainable Design Submittals:

1. Product Data: For adhesives, indicating VOC content.
2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
3. Product Data: For coatings, indicating VOC content.
4. Laboratory Test Reports: For coatings, indicating compliance with requirements for low-emitting materials.
5. Product Data: For sealants, indicating VOC content.
6. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.

C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail insulation application at elbows, fittings, dampers, specialties and flanges for each type of insulation.
3. Detail application of field-applied jackets.
4. Detail application at linkages of control devices.

D. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use. Sample sizes are as follows:

1. Sheet Form Insulation Materials: 12 inches square.
2. Sheet Jacket Materials: 12 inches square.
3. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

C. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 23 05 29 "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.8 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C534, Type II for sheet materials.

G. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C553, Type II and ASTM C1290, Type II with factory-applied vinyl jacket, Type III with factory-applied FSK jacket, Type III with factory-applied FSP jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

H. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied ASJ or with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

I. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied ASJ complying with ASTM C1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C612, Type IB. Nominal density is 2.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 100 deg F is 0.29 Btu x in./h x sq. ft. x deg F or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

J. Polyolefin: Unicellular, polyethylene thermal plastic insulation. Comply with ASTM C534 or ASTM C1427, Type I, Grade 1 for tubular materials and Type II, Grade 1 for sheet materials.

2.2 FIRE-RATED INSULATION SYSTEMS

A. Fire-Rated Board: Structural-grade, press-molded, xonolite calcium silicate, fireproofing board suitable for operating temperatures up to 1700 deg F. Comply with ASTM C656, Type II, Grade 6. Tested and certified to provide a 2-hour fire rating by an NRTL acceptable to authorities having jurisdiction.

B. Fire-Rated Blanket: High-temperature, flexible, blanket insulation with FSK jacket that is tested and certified to provide a 2-hour fire rating by an NRTL acceptable to authorities having jurisdiction.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. Verify adhesives have a VOC content of 50 g/L or less.

2. Verify adhesive complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Verify fiberglass adhesive has a VOC content of 80 g/L or less when calculated in accordance with 40 CFR 59, Subpart D (EPA Method 24).

2. Verify adhesive complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

D. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Verify adhesive has a VOC content of 80 g/L or less when calculated in accordance with 40 CFR 59, Subpart D (EPA Method 24).

2. Verify adhesive complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

E. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Verify adhesive has a VOC content of 80 g/L or less when calculated in accordance with 40 CFR 59, Subpart D (EPA Method 24).

2. Verify adhesive complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of

Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.4 MASTICS AND COATINGS

A. Materials shall be compatible with insulation materials, jackets, and substrates.

1. VOC Content: 300 g/L or less.

2. Low-Emitting Materials: Verify mastic coatings comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. Vapor-Retarder Mastic: Water based; suitable for indoor use on below ambient services.

1. Water-Vapor Permeance: Comply with ASTM C755, Section 7.2.2, Table 2, for insulation type and service conditions.

2. Service Temperature Range: Minus 20 to plus 180 deg F.

3. Comply with MIL-PRF-19565C, Type II, for permeance requirements.

4. Color: White.

C. Vapor-Retarder Mastic: Solvent based; suitable for indoor use on below ambient services.

1. Water-Vapor Permeance: Comply with ASTM C755, Section 7.2.2, Table 2, for insulation type and service conditions.

2. Service Temperature Range: 0 to 180 deg F.

3. Color: White.

D. Vapor-Retarder Mastic: Solvent based; suitable for outdoor use on below ambient services.

1. Water-Vapor Permeance: Comply with ASTM C755, Section 7.2.2, Table 2, for insulation type and service conditions.

2. Service Temperature Range: Minus 50 to plus 220 deg F.

3. Color: White.

E. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Water-Vapor Permeance: ASTM E96, greater than 1.0 perm at manufacturer's recommended dry film thickness.

2. Service Temperature Range: Minus 20 to plus 180 deg F.

3. Color: White.

2.5 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.

1. Verify adhesives have a VOC content of 50 g/L or less.

2. Verify adhesive complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct insulation.

4. Service Temperature Range: 0 to plus 180 deg F.

5. Color: White.

2.6 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.

2. Fire- and water-resistant, flexible, elastomeric sealant.

3. Service Temperature Range: Minus 40 to plus 250 deg F.

4. Color: Aluminum.

5. Verify sealant has a VOC content of 420 g/L or less.
6. Verify sealant complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. ASJ Flashing Sealants, and Vinyl and PVC Jacket Flashing Sealants:
1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: White.
5. Verify sealant has a VOC content of 420 g/L or less.
6. Verify sealant complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.7 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C1136, Type II.
4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C1136, Type II.
5. Vinyl Jacket: White vinyl with a permeance of 1.3 perms when tested according to ASTM E96/E96M, Procedure A, and complying with NFPA 90A and NFPA 90B.

2.8 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Glass-Fiber Fabric: Approximately 6 oz./sq. yd. with a thread count of 5 strands by 5 strands/sq. in. for covering ducts.

B. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in., in a Leno weave, for ducts.

2.9 FIELD-APPLIED CLOTHS

A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd..

2.10 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C921, Type I, unless otherwise indicated.

B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
1. Adhesive: As recommended by jacket material manufacturer.
2. Color: White.

D. Metal Jacket:
1. Aluminum Jacket: Comply with ASTM B209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
a. Factory cut and rolled to size.
b. Finish and thickness are indicated in field-applied jacket schedules.

c. Moisture Barrier for Indoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.

d. Moisture Barrier for Outdoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.

2. Stainless-Steel Jacket: ASTM A167 or ASTM A240/A240M.

a. Factory cut and rolled to size.

b. Material, finish, and thickness are indicated in field-applied jacket schedules.

c. Moisture Barrier for Indoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.

d. Moisture Barrier for Outdoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.

E. Self-Adhesive Outdoor Jacket: 60-mil-thick, laminated vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; consisting of a rubberized bituminous resin on a crosslaminated polyethylene film covered with white aluminum-foil facing.

2.11 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C1136.

1. Width: 3 inches.

2. Thickness: 11.5 mils.

3. Adhesion: 90 ounces force/inch in width.

4. Elongation: 2 percent.

5. Tensile Strength: 40 lbf/inch in width.

6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C1136.

1. Width: 3 inches.

2. Thickness: 6.5 mils.

3. Adhesion: 90 ounces force/inch in width.

4. Elongation: 2 percent.

5. Tensile Strength: 40 lbf/inch in width.

6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

1. Width: 2 inches.

2. Thickness: 6 mils.

3. Adhesion: 64 ounces force/inch in width.

4. Elongation: 500 percent.

5. Tensile Strength: 18 lbf/inch in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Width: 2 inches.

2. Thickness: 3.7 mils.

3. Adhesion: 100 ounces force/inch in width.

4. Elongation: 5 percent.

5. Tensile Strength: 34 lbf/inch in width.

2.12 SECUREMENTS

A. Bands:

1. Stainless Steel: ASTM A167 or ASTM A240/A240M, Type 304 or Type 316; 0.015 inch thick, 3/4 inch wide with wing seal or closed seal.
2. Aluminum: ASTM B209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing seal or closed seal.
3. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch-diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
    a. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
    b. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
    c. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
4. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
    a. Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1-1/2 inches in diameter.
    b. Spindle: Nylon, 0.106-inch-diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches.
    c. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
5. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
    a. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
    b. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
    c. Adhesive-backed base with a peel-off protective cover.
6. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
    a. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
7. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.

D. Wire: 0.062-inch soft-annealed, stainless steel.

2.13 CORNER ANGLES

A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D1784, Class 16354-C. White or color-coded to match adjacent surface.

B. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B209, Alloy 3003, 3005, 3105, or 5005; Temper H-14.

C. Stainless-Steel Corner Angles: 0.024 inch thick, minimum 1 by 1 inch, stainless steel according to ASTM A167 or ASTM A240/A240M, Type 304 or Type 316.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.

2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.

B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Keep insulation materials dry during application and finishing.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.

2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.

3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.

2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.

3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.

a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.

5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.

L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.

2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.

4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.

2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.

4. Seal jacket to wall flashing with flashing sealant.

C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.

1. Comply with requirements in Section 07 84 13 "Penetration Firestopping."

E. Insulation Installation at Floor Penetrations:

1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.

2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 07 84 13 "Penetration Firestopping."

3.5 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.6 INSTALLATION OF MINERAL-FIBER INSULATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
    a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    d. Do not overcompress insulation during installation.
    e. Impale insulation over pins and attach speed washers.
    f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
    a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
    a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.

b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.

c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.

d. Do not overcompress insulation during installation.

e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.

b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.

5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.

6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.7 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.

2. Embed glass cloth between two 0.062-inch-thick coats of lagging adhesive.

3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.

2. Install lap or joint strips with same material as jacket.

3. Secure jacket to insulation with manufacturer's recommended adhesive.

4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch-wide joint strips at end joints.

5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.8 FIRE-RATED INSULATION SYSTEM INSTALLATION

A. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous fire rating.

B. Insulate duct access panels and doors to achieve same fire rating as duct.

C. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Section 07 84 13 "Penetration Firestopping."

3.9 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting."

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.10 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.

D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.11 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed supply and outdoor air.
2. Indoor, exposed supply and outdoor air.
3. Indoor, concealed return located in unconditioned space.
4. Indoor, exposed return located in unconditioned space.
5. Indoor, concealed, Type I, commercial, kitchen hood exhaust.
6. Indoor, exposed, Type I, commercial, kitchen hood exhaust.
7. Indoor, concealed oven and warewash exhaust.
8. Indoor, exposed oven and warewash exhaust.
9. Indoor, concealed exhaust between isolation damper and penetration of building exterior.
10. Indoor, exposed exhaust between isolation damper and penetration of building exterior.
11. Outdoor, concealed supply and return.
12. Outdoor, exposed supply and return.

B. Items Not Insulated:

1. Fibrous-glass ducts.
2. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
3. Factory-insulated flexible ducts.
4. Factory-insulated plenums and casings.

5. Flexible connectors.
6. Vibration-control devices.
7. Factory-insulated access panels and doors.

3.12 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed, round and flat-oval, supply-air duct insulation shall be one of the following:
1. Flexible Elastomeric: 1 inch thick.
2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
3. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
4. Polyolefin: 1 inch thick.

B. Concealed, round and flat-oval, return-air duct insulation shall be one of the following:
1. Flexible Elastomeric: 1 inch thick.
2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
3. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
4. Polyolefin: 1 inch thick.

C. Concealed, round and flat-oval, outdoor-air duct insulation shall be one of the following:
1. Flexible Elastomeric: 1 inch thick.
2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
3. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
4. Polyolefin: 1 inch thick.

D. Concealed, round and flat-oval, exhaust-air duct insulation shall be one of the following:
1. Flexible Elastomeric: 1 inch thick.
2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
3. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
4. Polyolefin: 1 inch thick.

E. Concealed, rectangular, supply-air duct insulation shall be one of the following:
1. Flexible Elastomeric: 1 inch thick.
2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
3. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
4. Polyolefin: 1 inch thick.

F. Concealed, rectangular, return-air duct insulation shall be one of the following:
1. Flexible Elastomeric: 1 inch thick.
2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
3. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
4. Polyolefin: 1 inch thick.

G. Concealed, rectangular, outdoor-air duct insulation shall be one of the following:
1. Flexible Elastomeric: 1 inch thick.
2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
3. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
4. Polyolefin: 1 inch thick.

H. Concealed, rectangular, exhaust-air duct insulation between isolation damper and penetration of building exterior shall be one of the following:
1. Flexible Elastomeric: 1 inch thick.
2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
3. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
4. Polyolefin: 1 inch thick.

I. Concealed, Type I, Commercial, Kitchen Hood Exhaust Duct and Plenum Insulation: Fire-rated blanket or board; thickness as required to achieve 2-hour fire rating.

J. Concealed, supply-air plenum insulation shall be one of the following:
   1. Flexible Elastomeric: 1 inch thick.
   2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
   3. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
   4. Polyolefin: 1 inch thick.

K. Concealed, return-air plenum insulation shall be one of the following:
   1. Flexible Elastomeric: 1 inch thick.
   2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
   3. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
   4. Polyolefin: 1 inch thick.

L. Concealed, outdoor-air plenum insulation shall be one of the following:
   1. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
   2. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.

M. Concealed, exhaust-air plenum insulation shall be one of the following:
   1. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
   2. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.

N. Exposed, round and flat-oval, supply-air duct insulation shall be one of the following:
   1. Flexible Elastomeric: 1 inch thick.
   2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
   3. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
   4. Mineral-Fiber Pipe and Tank: 1-1/2 inches thick.
   5. Polyolefin: 1 inch thick.

O. Exposed, round and flat-oval, return-air duct insulation shall be one of the following:
   1. Flexible Elastomeric: 1 inch thick.
   2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
   3. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
   4. Mineral-Fiber Pipe and Tank: 1-1/2 inches thick.
   5. Polyolefin: 1 inch thick.

P. Exposed, round and flat-oval, outdoor-air duct insulation shall be one of the following:
   1. Flexible Elastomeric: 1 inch thick.
   2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
   3. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
   4. Mineral-Fiber Pipe and Tank: 1-1/2 inches thick.
   5. Polyolefin: 1 inch thick.

Q. Exposed, round and flat-oval, exhaust-air duct insulation shall be one of the following:
   1. Flexible Elastomeric: 1 inch thick.
   2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
   3. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
   4. Mineral-Fiber Pipe and Tank: 1-1/2 inches thick.
   5. Polyolefin: 1 inch thick.

R. Exposed, rectangular, supply-air duct insulation shall be one of the following:
   1. Flexible Elastomeric: 1 inch thick.
   2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.

3. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
4. Polyolefin: 1 inch thick.

S. Exposed, rectangular, return-air duct insulation shall be one of the following:
1. Flexible Elastomeric: 1 inch thick.
2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
3. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
4. Polyolefin: 1 inch thick.

T. Exposed, rectangular, outdoor-air duct insulation shall be one of the following:
1. Flexible Elastomeric: 1 inch thick.
2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
3. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
4. Polyolefin: 1 inch thick.

U. Exposed, rectangular, exhaust-air duct insulation shall be one of the following:
1. Flexible Elastomeric: 1 inch thick.
2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
3. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
4. Polyolefin: 1 inch thick.

V. Exposed, Type I, Commercial, Kitchen Hood Exhaust Duct and Plenum Insulation: Fire-rated blanket or board; thickness as required to achieve 2-hour fire rating.

W. Exposed, supply-air plenum insulation shall be one of the following:
1. Flexible Elastomeric: 1 inch thick.
2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
3. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
4. Polyolefin: 1 inch thick.

X. Exposed, return-air plenum insulation shall be one of the following:
1. Flexible Elastomeric: 1 inch thick.
2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
3. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
4. Polyolefin: 1 inch thick.

Y. Exposed, outdoor-air plenum insulation shall be one of the following:
1. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
2. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.

Z. Exposed, exhaust-air plenum insulation shall be one of the following:
1. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
2. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.

3.13 ABOVEGROUND, OUTDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Insulation materials and thicknesses are identified below. If more than one material is listed for a duct system, selection from materials listed is Contractor's option.

B. Concealed, round and flat-oval, supply-air duct insulation shall be one of the following:
1. Mineral-Fiber Blanket: 2 inches and 0.75-lb/cu. ft. nominal density.
2. Mineral-Fiber Board: 2 inches thick and 2-lb/cu. ft. nominal density.

C. Concealed, round and flat-oval, return-air duct insulation shall be one of the following:
1. Mineral-Fiber Blanket: 2 inches and 0.75-lb/cu. ft. nominal density.
2. Mineral-Fiber Board: 2 inches thick and 2-lb/cu. ft. nominal density.

D. Concealed, round and flat-oval, outdoor-air duct insulation shall be one of the following:

1. Mineral-Fiber Blanket: 2 inches and 0.75-lb/cu. ft. nominal density.
2. Mineral-Fiber Board: 2 inches thick and 2-lb/cu. ft. nominal density.

E. Concealed, rectangular, supply-air duct insulation shall be one of the following:
1. Mineral-Fiber Blanket: 2 inches and 0.75-lb/cu. ft. nominal density.
2. Mineral-Fiber Board: 2 inches thick and 2-lb/cu. ft. nominal density.

F. Concealed, rectangular, return-air duct insulation shall be one of the following:
1. Mineral-Fiber Blanket: 2 inches and 0.75-lb/cu. ft. nominal density.
2. Mineral-Fiber Board: 2 inches thick and 2-lb/cu. ft. nominal density.

G. Concealed, supply-air plenum insulation shall be one of the following:
1. Mineral-Fiber Blanket: 2 inches and 0.75-lb/cu. ft. 1.5-lb/cu. ft. nominal density.
2. Mineral-Fiber Board: 2 inches thick and 2-lb/cu. ft. nominal density.

H. Concealed, return-air plenum insulation shall be one of the following:
1. Mineral-Fiber Blanket: 2 inches and 0.75-lb/cu. ft. nominal density.
2. Mineral-Fiber Board: 2 inches thick and 2-lb/cu. ft. nominal density.

I. Exposed, round and flat-oval, supply-air duct insulation shall be one of the following:
1. Mineral-Fiber Blanket: 2 inches and 0.75-lb/cu. ft. nominal density.
2. Mineral-Fiber Board: 2 inches thick and 2-lb/cu. ft. nominal density.
3. Mineral-Fiber Pipe and Tank: 1-1/2 inches thick.

J. Exposed, round and flat-oval, return-air duct insulation shall be one of the following:
1. Mineral-Fiber Blanket: 2 inches and 0.75-lb/cu. ft. nominal density.
2. Mineral-Fiber Board: 2 inches thick and 2-lb/cu. ft. nominal density.

K. Exposed, rectangular, supply-air duct insulation shall be one of the following:
1. Mineral-Fiber Blanket: 2 inches and 0.75-lb/cu. ft. nominal density.
2. Mineral-Fiber Board: 2 inches thick and 2-lb/cu. ft. nominal density.

L. Exposed, rectangular, return-air duct insulation shall be one of the following:
1. Mineral-Fiber Blanket: 2 inches and 0.75-lb/cu. ft. nominal density.
2. Mineral-Fiber Board: 2 inches thick and 2-lb/cu. ft. nominal density.

M. Exposed, supply-air plenum insulation shall be one of the following:
1. Mineral-Fiber Blanket: 2 inches and 0.75-lb/cu. ft. nominal density.
2. Mineral-Fiber Board: 2 inches thick and 2-lb/cu. ft. nominal density.

N. Exposed, return-air plenum insulation shall be one of the following:
1. Mineral-Fiber Blanket: 2 inches and 0.75-lb/cu. ft. 1.5-lb/cu. ft. nominal density.
2. Mineral-Fiber Board: 2 inches thick and 2-lb/cu. ft. nominal density.

3.14 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Ducts and Plenums, Concealed:
1. Aluminum, Smooth: 0.020 inch thick.

D. Ducts and Plenums, Exposed:
1. Aluminum, Smooth: 0.020 inch thick.

3.15 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Ducts and Plenums, Concealed:

1. Aluminum, Smooth: 0.020 inch thick.

D. Ducts and Plenums, Exposed, up to 48 Inches in Diameter or with Flat Surfaces up to 72 Inches:

1. Aluminum, Smooth: 0.024 inch thick.

E. Ducts and Plenums, Exposed, Larger Than 48 Inches in Diameter or with Flat Surfaces Larger Than 72 Inches:

1. Stainless Steel, Type 304 or Type 316, Smooth, with: 0.020 inch thick.

END OF SECTION

SECTION 23 07 19 - HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes insulation for HVAC piping systems.

B. Related Requirements:

1. Section 23 07 13 "Duct Insulation" for duct insulation.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).

B. Sustainable Design Submittals:

1. Product Data: For adhesives, mastics, and sealants, indicating VOC content.
2. Laboratory Test Reports: For adhesives, mastics, and sealants, indicating compliance with requirements for low-emitting materials.

C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail attachment and covering of heat tracing inside insulation.
3. Detail insulation application at pipe expansion joints for each type of insulation.
4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
5. Detail removable insulation at piping specialties.
6. Detail application of field-applied jackets.
7. Detail application at linkages of control devices.

D. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use.

1. Preformed Pipe Insulation Materials: 12 inches long by NPS 2.
2. Sheet Form Insulation Materials: 12 inches square.
3. Jacket Materials for Pipe: 12 inches long by NPS 2.
4. Sheet Jacket Materials: 12 inches square.
5. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

C. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products in accordance with ASTM E84, by a testing agency acceptable to authorities

having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 23 05 29 "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.8 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come into contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested in accordance with ASTM C871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable in accordance with ASTM C795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Calcium Silicate: Preformed Pipe Sections: Flat-, curved-, and grooved-block sections of noncombustible, inorganic, hydrous calcium silicate with a non-asbestos fibrous reinforcement. Comply with ASTM C533, Type I.

1. Prefabricated Fitting Covers: Comply with ASTM C450 and ASTM C585 for dimensions used in preforming insulation to cover valves, elbows, tees, and flanges.

G. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Comply with ASTM C552.

1. Preformed Pipe Insulation without Jacket: Type II, Class 1, without jacket.
2. Preformed Pipe Insulation with Jacket: Type II, Class 2, with factory-applied ASJ jacket.
3. Factory fabricate shapes in accordance with ASTM C450 and ASTM C585.
4. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

H. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C534/C534M, Type I for tubular materials, Type II for sheet materials.

I. Mineral-Fiber, Preformed Pipe: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C547.

1. Preformed Pipe Insulation: Type I, Grade A, without factory-applied jacket.
2. 850 deg F.
3. Factory fabricate shapes in accordance with ASTM C450 and ASTM C585.
4. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

J. Mineral-Fiber, Pipe and Tank: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C1393.
1. Semirigid board material with factory-applied ASJ jacket.
2. Nominal density is 2.5 lb/cu. ft. or more.
3. Thermal conductivity (k-value) at 100 deg F is 0.29 Btu x in./h x sq. ft. x deg F or less.
4. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

K. Phenolic: Preformed pipe insulation of rigid, expanded, closed-cell structure. Comply with ASTM C1126.
1. Preformed Pipe Insulation: Type III, without factory-applied jacket.
2. Factory fabricate shapes in accordance with ASTM C450 and ASTM C585.
3. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

L. Polyisocyanurate: Preformed, rigid cellular polyisocyanurate material intended for use as thermal insulation. Comply with ASTM C591.
1. Preformed insulation, without factory-applied jacket.
2. Type IV, except thermal conductivity (k-value) shall not exceed 0.19 Btu x in./h x sq. ft. x deg F at 75 deg F after 180 days of aging.
3. Flame-spread index shall be 25 or less, and smoke-developed index shall be 50 or less for thicknesses of up to 1 inch as tested in accordance with ASTM E84.
4. Fabricate shapes in accordance with ASTM C450 and ASTM C585.
5. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

M. Polyolefin: Unicellular, polyethylene thermal plastic insulation. Comply with ASTM C534/C534M or ASTM C1427, Type I, Grade 1, for tubular materials and with Type II, Grade 1, for sheet materials.

N. Polystyrene: Rigid, extruded cellular polystyrene intended for use as thermal insulation. Comply with ASTM C578, Type IV or Type XIII, except thermal conductivity (k-value) shall not exceed 0.26 Btu x in./h x sq. ft. x deg F after 180 days of aging. Fabricate shapes in accordance with ASTM C450 and ASTM C585.

2.2 INSULATING CEMENTS

A. Mineral-Fiber Insulating Cement: Comply with ASTM C195.

B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C196.

C. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C449.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Calcium Silicate Adhesive: Fibrous, sodium-silicate-based adhesive with a service temperature range of 50 to 800 deg F.
1. Adhesive: As recommended by calcium silicate manufacturer and with a VOC content of 50 g/L or less.
2. Verify adhesive complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

C. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F.

1. Adhesive: As recommended by cellular glass manufacturer and with a VOC content of 80 g/L or less.
2. Verify adhesive complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

D. Phenolic and Polyisocyanurate Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F.

1. Adhesive: As recommended by phenolic and polyisocyanate manufacturer and with a VOC content of 50 g/L or less.
2. Verify adhesive complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

E. Flexible Elastomeric and Polyolefin Adhesive: Solvent-based adhesive.

1. Adhesive: As recommended by flexible elastomeric and polyolefin manufacturer and with a VOC content of 80 g/L or less.
2. Verify adhesive complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
3. Flame-spread index shall be 25 or less and smoke-developed index shall be 50 or less as tested in accordance with ASTM E84.
4. Wet Flash Point: Below 0 deg F.
5. Service Temperature Range: 40 to 200 deg F.
6. Color: Black.

F. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Adhesive: As recommended by mineral fiber manufacturer and with a VOC content of 80 g/L or less.
2. Verify adhesive complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

G. Polystyrene Adhesive: Solvent- or water-based, synthetic resin adhesive with a service temperature range of minus 20 to plus 140 deg F.

1. Adhesive: As recommended by polystyrene manufacturer and with a VOC content of 50 g/L or less.
2. Verify adhesive complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

H. ASJ Adhesive and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A, for bonding insulation jacket lap seams and joints.

1. Verify adhesives have a VOC content of 50 g/L or less.
2. Verify adhesive complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

I. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Adhesive: As recommended by Adhesive - PVC Jacket manufacturer and with a VOC content of 50 g/L or less.

2. Verify adhesive complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.4 MASTICS AND COATINGS

A. Materials shall be compatible with insulation materials, jackets, and substrates.

1. Mastics: As recommended by insulation manufacturer and with a VOC content of 50 g/L or less.

2. Verify mastics comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. Vapor-Retarder Mastic, Water Based: Suitable for indoor use on below-ambient services.

1. Water-Vapor Permeance: Comply with ASTM E96/E96M or ASTM F1249.

2. Service Temperature Range: 0 to plus 180 deg F.

3. Comply with MIL-PRF-19565C, Type II, for permeance requirements.

4. Color: White.

C. Vapor-Retarder Mastic, Solvent Based, Indoor Use: Suitable for indoor use on below-ambient services.

1. Water-Vapor Permeance: Comply with ASTM E96/E96M or ASTM F1249.

2. Service Temperature Range: 0 to 180 deg F.

3. Color: White.

D. Vapor-Retarder Mastic, Solvent Based, Outdoor Use: Suitable for outdoor use on below-ambient services.

1. Water-Vapor Permeance: Comply with ASTM E96/E96M or ASTM F1249.

2. Service Temperature Range: Minus 50 to plus 220 deg F.

3. Color: White.

E. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.

1. Water-Vapor Permeance: ASTM E96/E96M, greater than 1.0 perm at manufacturer's recommended dry film thickness.

2. Service Temperature Range: 0 to plus 180 deg F.

3. Color: White.

2.5 LAGGING ADHESIVES

A. Adhesives shall comply with MIL-A-3316C, Class I, Grade A, and shall be compatible with insulation materials, jackets, and substrates.

1. Verify adhesive is as recommended by insulation manufacturer and has a VOC content of 50 g/L or less.

2. Verify adhesive complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.

4. Service Temperature Range: 20 to plus 180 deg F.

5. Color: White.

2.6 SEALANTS

A. Materials shall be as recommended by the insulation manufacturer and shall be compatible with insulation materials, jackets, and substrates.

B. Joint Sealants:

1. Permanently flexible, elastomeric sealant.
    a. Service Temperature Range: Minus 150 to plus 250 deg F.
    b. Color: White or gray.
2. Verify sealant has a VOC content of 420 g/L or less.
3. Verify sealant complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

C. FSK and Metal Jacket Flashing Sealants:
1. Fire- and water-resistant, flexible, elastomeric sealant.
2. Service Temperature Range: Minus 40 to plus 250 deg F.
3. Color: Aluminum.
4. Verify sealant has a VOC content of 420 g/L or less.
5. Verify sealant complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

D. ASJ Flashing Sealants and PVDC and PVC Jacket Flashing Sealants:
1. Fire- and water-resistant, flexible, elastomeric sealant.
2. Service Temperature Range: Minus 40 to plus 250 deg F.
3. Color: White.
4. Verify sealant has a VOC content of 420 g/L or less.
5. Verify sealant complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.7 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C1136, Type II.

2.8 FIELD-APPLIED REINFORCING MESH

A. Woven Glass-Fiber Mesh: Approximately 2 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in. for covering pipe and pipe fittings.

B. Woven Polyester Mesh: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in., in a Leno weave, for pipe.

2.9 FIELD-APPLIED CLOTHS

A. Woven Glass-Fiber Cloth: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd..

2.10 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C1136, Type I, unless otherwise indicated.

B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Adhesive: As recommended by jacket material manufacturer.
2. Color: White.
3. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
    a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

D. Metal Jacket:
1. Aluminum Jacket: Comply with ASTM B209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
    a. Factory cut and rolled to size.
    b. Finish and thickness are indicated in field-applied jacket schedules.
    c. Moisture Barrier for Indoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.
    d. Moisture Barrier for Outdoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.
    e. Factory-Fabricated Fitting Covers:
        1) Same material, finish, and thickness as jacket.
        2) Preformed two-piece or gore, 45- and 90-degree, short- and long-radius elbows.
        3) Tee covers.
        4) Flange and union covers.
        5) End caps.
        6) Beveled collars.
        7) Valve covers.
        8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.
2. Stainless Steel Jacket: ASTM A240/A240M.
    a. Factory cut and rolled to size.
    b. Material, finish, and thickness are indicated in field-applied jacket schedules.
    c. Moisture Barrier for Indoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.
    d. Moisture Barrier for Outdoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.
    e. Factory-Fabricated Fitting Covers:
        1) Same material, finish, and thickness as jacket.
        2) Preformed two-piece or gore, 45- and 90-degree, short- and long-radius elbows.
        3) Tee covers.
        4) Flange and union covers.
        5) End caps.
        6) Beveled collars.
        7) Valve covers.
        8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

E. Underground Direct-Buried Jacket: 125-mil-thick vapor barrier and waterproofing membrane, consisting of a rubberized bituminous resin reinforced with a woven-glass fiber or polyester scrim and laminated aluminum foil.

F. Self-Adhesive Outdoor Jacket: 60-mil-thick, laminated vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; consisting of a rubberized bituminous resin on a cross-laminated polyethylene film covered with white aluminum-foil facing.

G. PVDC Jacket for Indoor Applications: 4-mil-thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perm when tested in accordance with ASTM E96/E96M and with a flame-spread index of 10 and a smoke-developed index of 20 when tested in accordance with ASTM E84.

H. PVDC Jacket for Outdoor Applications: 6-mil-thick, white PVDC biaxially oriented barrier film with a permeance at 0.01 perm when tested in accordance with ASTM E96/E96M and with a flame-spread index of 25 and a smoke-developed index of 50 when tested in accordance with ASTM E84.

I. PVDC-SSL Jacket: PVDC jacket with a self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip.

2.11 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C1136.

1. Width: 3 inches.
2. Thickness: 11.5 mils.
3. Adhesion: 90 ounces force/inch in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch in width.
6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C1136.

1. Width: 3 inches.
2. Thickness: 6.5 mils.
3. Adhesion: 90 ounces force/inch in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch in width.
6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

1. Width: 2 inches.
2. Thickness: 6 mils.
3. Adhesion: 64 ounces force/inch in width.
4. Elongation: 500 percent.
5. Tensile Strength: 18 lbf/inch in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Width: 2 inches.
2. Thickness: 3.7 mils.
3. Adhesion: 100 ounces force/inch in width.
4. Elongation: 5 percent.
5. Tensile Strength: 34 lbf/inch in width.

E. PVDC Tape for Indoor Applications: White vapor-retarder PVDC tape with acrylic adhesive.

1. Width: 3 inches.
2. Film Thickness: 2 mils.
3. Adhesive Thickness: 1.5 mils.

4. Elongation at Break: 120 percent.
5. Tensile Strength: 20 psi in width.

F. PVDC Tape for Outdoor Applications: White vapor-retarder PVDC tape with acrylic adhesive.
1. Width: 3 inches.
2. Film Thickness: 6 mils.
3. Adhesive Thickness: 1.5 mils.
4. Elongation at Break: 145 percent.
5. Tensile Strength: 55 psi in width.

2.12 SECUREMENTS

A. Bands:
1. Stainless Steel: ASTM A240/A240M, Type 304 or Type 316; 0.015 inch thick, 1/2 inch wide with wing seal or closed seal.
2. Aluminum: ASTM B209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal or closed seal.

B. Wire: 0.080-inch nickel-copper alloy.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
2. Carbon Steel: Coat carbon steel operating at a service temperature of between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

C. Coordinate insulation installation with the tradesman installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and of thicknesses required for each item of pipe system, as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during storage, application, and finishing. Replace insulation materials that get wet.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.

2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends attached to structure with vapor-barrier mastic.

3. Install insert materials and insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.

2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward-clinching staples along both edges of strip, spaced 4 inches o.c.

3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward-clinching staples along edge at 2 inches o.c.

a. For below-ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, in accordance with insulation material manufacturer's written instructions, to maintain vapor seal.

5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 25 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches in similar fashion to butt joints.

P. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.

2. Testing agency labels and stamps.

3. Nameplates and data plates.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.

2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install

insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.

4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.

2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.

4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Section 07 84 13 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.

2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 07 84 13 "Penetration Firestopping."

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials, except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, Mechanical Couplings, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, mechanical couplings, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.

2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as that of adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.

3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as that used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.

4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as that used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.

5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as that used for adjacent pipe. Overlap adjoining pipe

insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers, so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.

6. Insulate flanges, mechanical couplings, and unions using a section of oversized preformed pipe insulation to fit. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Stencil or label the outside insulation jacket of each union with the word "union" matching size and color of pipe labels.

7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.

8. For services not specified to receive a field-applied jacket, except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing, using PVC tape.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as that of adjoining pipe insulation.

2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union at least 2 times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless steel or aluminum bands. Select band material compatible with insulation and jacket.

3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.

4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.

5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 INSTALLATION OF CALCIUM SILICATE INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure single-layer insulation with stainless steel bands at 12-inch intervals, and tighten bands without deforming insulation materials.

2. Install two-layer insulation with joints tightly butted and staggered at least 3 inches. Secure inner layer with wire spaced at 12-inch intervals. Secure outer layer with stainless steel bands at 12-inch intervals.

3. Apply a skim coat of mineral-fiber, hydraulic-setting cement to insulation surface. When cement is dry, apply flood coat of lagging adhesive and press on one layer of glass cloth or tape. Overlap edges at least 1 inch. Apply finish coat of lagging adhesive over glass cloth or tape. Thin finish coat to achieve smooth, uniform finish.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.

2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of block insulation of same material and thickness as that of pipe insulation.
4. Finish flange insulation same as pipe insulation.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as that of straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed insulation sections of insulation are not available, install mitered sections of calcium silicate insulation. Secure insulation materials with wire or bands.
3. Finish fittings insulation same as pipe insulation.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install mitered segments of calcium silicate insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
2. Install insulation to flanges as specified for flange insulation application.
3. Finish valve and specialty insulation same as pipe insulation.

3.7 INSTALLATION OF CELLULAR-GLASS INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands, and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward-clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as that of pipe insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as that of straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.8 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as that of pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as that of pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.9 INSTALLATION OF MINERAL-FIBER INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands, and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as that of straight segments of pipe insulation when available.

2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as that of straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.10 INSTALLATION OF PHENOLIC INSULATION

A. General Installation Requirements:

1. Secure single-layer insulation with stainless steel bands at 12-inch intervals, and tighten bands without deforming insulation materials.
2. Install two-layer insulation with joints tightly butted and staggered at least 3 inches. Secure inner layer with 0.062-inch wire spaced at 12-inch intervals. Secure outer layer with stainless steel bands at 12-inch intervals.

B. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands, and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward-clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets with vapor retarders on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic and flashing sealant.

C. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of block insulation of same material and thickness as that of pipe insulation.

D. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed insulation sections of same material as that of straight segments of pipe insulation. Secure according to manufacturer's written instructions.

E. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed insulation sections of same material as that of straight segments of pipe insulation. Secure according to manufacturer's written instructions.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.11 INSTALLATION OF POLYISOCYANURATE INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with tape or bands and tighten without deforming insulation materials. Orient longitudinal joints between half sections in 3- and 9-o'clock positions on the pipe.

2. For insulation with factory-applied jackets with vapor barriers, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive or tape, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic.
3. All insulation shall be tightly butted and free of voids and gaps at all joints. Vapor barrier must be continuous. Before installing jacket material, install vapor-barrier system.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, and same thickness as that of adjacent pipe insulation, not to exceed 1-1/2-inch thickness.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of polyisocyanurate block insulation of same thickness as that of pipe insulation.

C. Insulation Installation on Fittings and Elbows:

1. Install preformed sections of same material as that of straight segments of pipe insulation. Secure according to manufacturer's written instructions.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of polyisocyanurate insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.12 INSTALLATION OF POLYOLEFIN INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Seal split-tube longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of polyolefin sheet insulation of same thickness as that of pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of polyolefin pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install cut sections of polyolefin pipe and sheet insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.13 INSTALLATION OF POLYSTYRENE INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation with tape or bands and tighten bands without deforming insulation materials. Orient longitudinal joints between half sections in 3- and 9-o'clock positions on the pipe.
2. For insulation with factory-applied jackets with vapor barriers, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive or tape, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic.
3. All insulation shall be tightly butted and free of voids and gaps at all joints. Vapor barrier must be continuous. Before installing jacket material, install vapor-barrier system.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, and make thickness same as that of adjacent pipe insulation, not to exceed 1-1/2 inches.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of polystyrene block insulation of same thickness that of as pipe insulation.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed insulation sections of same material as that of straight segments of pipe insulation. Secure according to manufacturer's written instructions.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed section of polystyrene insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.14 INSTALLATION OF FIELD-APPLIED JACKETS

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch-thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch-wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where PVC jackets are indicated and for horizontal applications, install with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless steel bands 12 inches o.c. and at end joints.

E. Where PVDC jackets are indicated, install as follows:

1. Apply three separate wraps of filament tape per insulation section to secure pipe insulation to pipe prior to installation of PVDC jacket.
2. Wrap factory-presized jackets around individual pipe insulation sections, with one end overlapping the previously installed sheet. Install presized jacket with an approximate

overlap at butt joint of 2 inches over the previous section. Adhere lap seal using adhesive or SSL, and then apply 1-1/4 circumferences of appropriate PVDC tape around overlapped butt joint.

3. Continuous jacket can be spiral-wrapped around a length of pipe insulation. Apply adhesive or PVDC tape at overlapped spiral edge. When electing to use adhesives, refer to manufacturer's written instructions for application of adhesives along this spiral edge to maintain a permanent bond.

4. Jacket can be wrapped in cigarette fashion along length of roll for insulation systems with an outer circumference of 33-1/2 inches or less. The 33-1/2-inch-circumference limit allows for 2-inch-overlap seal. Using the length of roll allows for longer sections of jacket to be installed at one time. Use adhesive on the lap seal. Visually inspect lap seal for "fishmouthing," and use PVDC tape along lap seal to secure joint.

5. Repair holes or tears in PVDC jacket by placing PVDC tape over the hole or tear and wrapping a minimum of 1-1/4 circumferences to avoid damage to tape edges.

3.15 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting."

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless steel jackets.

3.16 FIELD QUALITY CONTROL

A. Owner will engage a qualified testing agency to perform tests and inspections.

B. Engage a qualified testing agency to perform tests and inspections.

C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

D. Perform tests and inspections.

E. Tests and Inspections: Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

F. All insulation applications will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports.

3.17 PIPING INSULATION SCHEDULE, GENERAL

A. Insulation conductivity and thickness per pipe size shall comply with schedules in this Section or with requirements of authorities having jurisdiction, whichever is more stringent.

B. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

C. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Underground piping.

2. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.18 INDOOR PIPING INSULATION SCHEDULE

A. Condensate and Equipment Drain Water below 60 Deg F:
   1. All Pipe Sizes: Insulation shall be one of the following:
      a. Cellular Glass: 1-1/2 inches thick.
      b. Flexible Elastomeric: 1 inch thick.
      c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
      d. Phenolic: 1 inch thick.
      e. Polyisocyanurate: 1 inch thick.
      f. Polyolefin: 1 inch thick.

B. Chilled Water and Brine, 40 Deg F and below:
   1. NPS 3 Insert pipe size and Smaller: Insulation shall be one of the following:
      a. Cellular Glass: 1-1/2 inches thick.
      b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
      c. Phenolic: 1 inch thick.
      d. Polyisocyanurate: 1 inch thick.
   2. NPS 4 to NPS 12: Insulation shall be one of the following:
      a. Cellular Glass: 2 inches thick.
      b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick.
      c. Phenolic: 2 inches thick.
      d. Polyisocyanurate: 1 inch thick.

C. Condenser-Water Supply and Return:
   1. NPS 12 and Smaller: Insulation shall be one of the following:
      a. Cellular Glass: 2 inches thick.
      b. Flexible Elastomeric: 1 inch thick.
      c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
      d. Phenolic: 1 inch thick.
      e. Polyisocyanurate: 1 inch thick.
      f. Polyolefin: 1 inch thick.

D. Refrigerant Suction and Hot-Gas Piping:
   1. All Pipe Sizes: Insulation shall be one of the following:
      a. Cellular Glass: 1-1/2 inches thick.
      b. Flexible Elastomeric: 1 inch thick.
      c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
      d. Phenolic: 1 inch thick.
      e. Polyisocyanurate: 1 inch thick.
      f. Polyolefin: 1 inch thick.

E. Refrigerant Suction and Hot-Gas Flexible Tubing:
   1. All Pipe Sizes: Insulation shall be one of the following:
      a. Flexible Elastomeric: 2 inches thick.
      b. Polyolefin: 2 inches thick.

F. Refrigerant Liquid Piping:
   1. All Pipe Sizes: Insulation shall be one of the following:
      a. Cellular Glass: 1-1/2 inches thick.
      b. Flexible Elastomeric: 1 inch thick.

c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
d. Phenolic: 1 inch thick.
e. Polyisocyanurate: 1 inch thick.
f. Polyolefin: 1 inch thick.

3.19 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Condenser-Water Supply and Return:
1. All Pipe Sizes: Insulation shall be one of the following:
a. Cellular Glass: 2 inches thick.
b. Flexible Elastomeric: 2 inches thick.
c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick.
d. Phenolic: 2 inches thick.
e. Polyisocyanurate: 2 inches thick.
f. Polyolefin: 2 inches thick.
g. Polystyrene: 2 inches thick.

B. Refrigerant Suction and Hot-Gas Flexible Tubing:
1. All Pipe Sizes: Insulation shall be one of the following:
a. Flexible Elastomeric: 2 inches thick.
b. Polyolefin: 2 inches thick.

C. Refrigerant Liquid Piping:
1. All Pipe Sizes: Insulation shall be one of the following:
a. Flexible Elastomeric: 1 inch thick.
b. Polyolefin: 1 inch thick.

D. Heat-Recovery Piping:
1. All Pipe Sizes: Insulation shall be one of the following:
a. Cellular Glass: 2 inches thick.
b. Flexible Elastomeric: 2 inches thick.
c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick.
d. Phenolic: 2 inches thick.
e. Polyisocyanurate: 2 inches thick.
f. Polyolefin: 2 inches thick.
g. Polystyrene: 2 inches thick.

3.20 OUTDOOR, UNDERGROUND, PIPING INSULATION SCHEDULE

A. Condenser-Water Supply and Return, All Sizes: Cellular glass, 2 inches thick.
1. Calcium Silicate: 3 inches thick.
2. Cellular Glass: 3 inches thick.

3.21 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:
1. Aluminum, Smooth: 0.020 inch thick.

D. Piping, Exposed:
1. Aluminum, Smooth: 0.020 inch thick.

3.22 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:

1. Aluminum, Smooth: 0.020 inch thick.

D. Piping, Exposed:

1. Stainless Steel, Type 304 or Type 316, Smooth No. 2B Finish with Z-Shaped Locking Seam: 0.020 inch thick.

3.23 UNDERGROUND, FIELD-APPLIED INSULATION JACKET

A. For underground direct-buried piping applications, install underground direct-buried jacket over insulation material.

END OF SECTION

SECTION 23 23 00 - REFRIGERANT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes refrigerant piping used for air-conditioning applications.

1.3 PERFORMANCE REQUIREMENTS

A. Line Test Pressure for Refrigerant R-410A:

1. Suction Lines for Air-Conditioning Applications: 300 psig.
2. Suction Lines for Heat-Pump Applications: 535 psig.
3. Hot-Gas and Liquid Lines: 535 psig.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop, based on manufacturer's test data, for the following:

1. Thermostatic expansion valves.
2. Solenoid valves.
3. Hot-gas bypass valves.
4. Filter dryers.
5. Strainers.
6. Pressure-regulating valves.

B. Shop Drawings: Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes, flow capacities, valve arrangements and locations, slopes of horizontal runs, oil traps, double risers, wall and floor penetrations, and equipment connection details. Show interface and spatial relationships between piping and equipment.

1. Shop Drawing Scale: 1/4 inch equals 1 foot.
2. Refrigerant piping indicated on Drawings is schematic only. Size piping and design actual piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.

1.5 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Field quality-control test reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

B. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."

C. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

1.8 PRODUCT STORAGE AND HANDLING

A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

1.9 COORDINATION

A. Coordinate size and location of roof curbs, equipment supports, and roof penetrations. These items are specified in Section 07720 "Roof Accessories."

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Copper Tube: ASTM B 88, Type K or LASTM B 280, Type ACR.

B. Wrought-Copper Fittings: ASME B16.22.

C. Wrought-Copper Unions: ASME B16.22.

D. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.

E. Brazing Filler Metals: AWS A5.8.

F. Flexible Connectors:

1. Body: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket.
2. End Connections: Socket ends.
3. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch-long assembly.
4. Pressure Rating: Factory test at minimum 500 psig.
5. Maximum Operating Temperature: 250 deg F.

2.2 STEEL PIPE AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel with plain ends; Type, Grade, and wall thickness as selected in Part 3 piping applications articles.

B. Wrought-Steel Fittings: ASTM A 234/A 234M, for welded joints.

C. Steel Flanges and Flanged Fittings: ASME B16.5, steel, including bolts, nuts, and gaskets, bevel-welded end connection, and raised face.

D. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

E. Flanged Unions:

1. Body: Forged-steel flanges for NPS 1 to NPS 1-1/2 and ductile iron for NPS 2 to NPS 3. Apply rust-resistant finish at factory.
2. Gasket: Fiber asbestos free.
3. Fasteners: Four plated-steel bolts, with silicon bronze nuts. Apply rust-resistant finish at factory.
4. End Connections: Brass tailpiece adapters for solder-end connections to copper tubing.
5. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch-long assembly.
6. Pressure Rating: Factory test at minimum 400 psig.
7. Maximum Operating Temperature: 330 deg F.

F. Flexible Connectors:

1. Body: Stainless-steel bellows with woven, flexible, stainless-steel-wire-reinforced protective jacket
2. End Connections:
   a. NPS 2 and Smaller: With threaded-end connections.
   b. NPS 2-1/2 and Larger: With flanged-end connections.
3. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch-long assembly.
4. Pressure Rating: Factory test at minimum 500 psig.

5. Maximum Operating Temperature: 250 deg F.

2.3 VALVES AND SPECIALTIES

A. Diaphragm Packless Valves:
   1. Body and Bonnet: Forged brass or cast bronze; globe design with straight-through or angle pattern.
   2. Diaphragm: Phosphor bronze and stainless steel with stainless-steel spring.
   3. Operator: Rising stem and hand wheel.
   4. Seat: Nylon.
   5. End Connections: Socket, union, or flanged.
   6. Working Pressure Rating: 500 psig.
   7. Maximum Operating Temperature: 275 deg F.

B. Packed-Angle Valves:
   1. Body and Bonnet: Forged brass or cast bronze.
   2. Packing: Molded stem, back seating, and replaceable under pressure.
   3. Operator: Rising stem.
   4. Seat: Nonrotating, self-aligning polytetrafluoroethylene.
   5. Seal Cap: Forged-brass or valox hex cap.
   6. End Connections: Socket, union, threaded, or flanged.
   7. Working Pressure Rating: 500 psig.
   8. Maximum Operating Temperature: 275 deg F.

C. Check Valves:
   1. Body: Ductile iron, forged brass, or cast bronze; globe pattern.
   2. Bonnet: Bolted ductile iron, forged brass, or cast bronze; or brass hex plug.
   3. Piston: Removable polytetrafluoroethylene seat.
   4. Closing Spring: Stainless steel.
   5. Manual Opening Stem: Seal cap, plated-steel stem, and graphite seal.
   6. End Connections: Socket, union, threaded, or flanged.
   7. Maximum Opening Pressure: 0.50 psig.
   8. Working Pressure Rating: 500 psig.
   9. Maximum Operating Temperature: 275 deg F.

D. Service Valves:
   1. Body: Forged brass with brass cap including key end to remove core.
   2. Core: Removable ball-type check valve with stainless-steel spring.
   3. Seat: Polytetrafluoroethylene.
   4. End Connections: Copper spring.
   5. Working Pressure Rating: 500 psig.

E. Solenoid Valves: Comply with ARI 760 and UL 429; listed and labeled by an NRTL.
   1. Body and Bonnet: Plated steel.
   2. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
   3. Seat: Polytetrafluoroethylene.
   4. End Connections: Threaded.
   5. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch conduit adapter, and ac coil.
   6. Working Pressure Rating: 400 psig.
   7. Maximum Operating Temperature: 240 deg F.

8. Manual operator.

F. Safety Relief Valves: Comply with ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.
   1. Body and Bonnet: Ductile iron and steel, with neoprene O-ring seal.
   2. Piston, Closing Spring, and Seat Insert: Stainless steel.
   3. Seat Disc: Polytetrafluoroethylene.
   4. End Connections: Threaded.
   5. Working Pressure Rating: 400 psig.
   6. Maximum Operating Temperature: 240 deg F.

G. Thermostatic Expansion Valves: Comply with ARI 750.
   1. Body, Bonnet, and Seal Cap: Forged brass or steel.
   2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
   3. Packing and Gaskets: Non-asbestos.
   4. Capillary and Bulb: Copper tubing filled with refrigerant charge.
   5. Suction Temperature: 40 deg F.
   6. Superheat: Adjustable.
   7. Reverse-flow option (for heat-pump applications).
   8. End Connections: Socket, flare, or threaded union.
   9. Working Pressure Rating: 700 psig.

H. Hot-Gas Bypass Valves: Comply with UL 429; listed and labeled by an NRTL.
   1. Body, Bonnet, and Seal Cap: Ductile iron or steel.
   2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
   3. Packing and Gaskets: Non-asbestos.
   4. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
   5. Seat: Polytetrafluoroethylene.
   6. Equalizer: Internal.
   7. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch conduit adapter, and ac coil.
   8. End Connections: Socket.
   9. Throttling Range: Maximum 5 psig.
   10. Working Pressure Rating: 500 psig.
   11. Maximum Operating Temperature: 240 deg F.

I. Straight-Type Strainers:
   1. Body: Welded steel with corrosion-resistant coating.
   2. Screen: 100-mesh stainless steel.
   3. End Connections: Socket or flare.
   4. Working Pressure Rating: 500 psig.
   5. Maximum Operating Temperature: 275 deg F.

J. Angle-Type Strainers:
   1. Body: Forged brass or cast bronze.
   2. Drain Plug: Brass hex plug.
   3. Screen: 100-mesh monel.
   4. End Connections: Socket or flare.
   5. Working Pressure Rating: 500 psig.
   6. Maximum Operating Temperature: 275 deg F.

K. Moisture/Liquid Indicators:
   1. Body: Forged brass.
   2. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.
   3. Indicator: Color coded to show moisture content in ppm.
   4. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.
   5. End Connections: Socket or flare.
   6. Working Pressure Rating: 500 psig.
   7. Maximum Operating Temperature: 240 deg F.

L. Replaceable-Core Filter Dryers: Comply with ARI 730.
   1. Body and Cover: Painted-steel shell with ductile-iron cover, stainless-steel screws, and neoprene gaskets.
   2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
   3. Desiccant Media: Activated alumina.
   4. Designed for reverse flow (for heat-pump applications).
   5. End Connections: Socket.
   6. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.
   7. Maximum Pressure Loss: 2 psig.
   8. Rated Flow: Based upon HVAC tons of refrigeration.
   9. Working Pressure Rating: 500 psig.
   10. Maximum Operating Temperature: 240 deg F.

M. Permanent Filter Dryers: Comply with ARI 730.
   1. Body and Cover: Painted-steel shell.
   2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
   3. Desiccant Media: Activated alumina.
   4. Designed for reverse flow (for heat-pump applications).
   5. End Connections: Socket.
   6. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.
   7. Maximum Pressure Loss: 2 psig.
   8. Rated Flow: Based upon HVAC tons of refrigeration.
   9. Working Pressure Rating: 500 psig.
   10. Maximum Operating Temperature: 240 deg F.

N. Mufflers:
   1. Body: Welded steel with corrosion-resistant coating.
   2. End Connections: Socket or flare.
   3. Working Pressure Rating: 500 psig.
   4. Maximum Operating Temperature: 275 deg F.

O. Receivers: Comply with ARI 495.
   1. Comply with ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.
   2. Comply with UL 207; listed and labeled by an NRTL.
   3. Body: Welded steel with corrosion-resistant coating.
   4. Tappings: Inlet, outlet, liquid level indicator, and safety relief valve.
   5. End Connections: Socket or threaded.

6. Working Pressure Rating: 500 psig.
7. Maximum Operating Temperature: 275 deg F.

P. Liquid Accumulators: Comply with ARI 495.
1. Body: Welded steel with corrosion-resistant coating.
2. End Connections: Socket or threaded.
3. Working Pressure Rating: 500 psig.
4. Maximum Operating Temperature: 275 deg F.

2.4 REFRIGERANTS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Atofina Chemicals, Inc.
2. DuPont Company; Fluorochemicals Div.
3. Honeywell, Inc.; Genetron Refrigerants.
4. INEOS Fluor Americas LLC.

C. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS FOR REFRIGERANT R-410A

A. Suction Lines NPS 1-1/2and Smaller for Conventional Air-Conditioning Applications: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed or soldered joints.

B. Suction Lines NPS 3-1/2and Smaller for Conventional Air-Conditioning Applications: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.

C. Suction Lines NPS 4and Smaller for Conventional Air-Conditioning Applications: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with soldered joints.

D. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications: Copper, Type ACR, annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.

E. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications:
1. NPS 5/8and Smaller: Copper, Type ACR, annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.
2. NPS 3/4 to NPS 1and Smaller: Copper, Type K, annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.
3. NPS 1-1/4 and Smaller: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with 95-5 tin-antimony soldered joints.
4. NPS 1-1/2 to NPS 2: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with Alloy HB soldered joints.

F. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications NPS 2 to NPS 4: Schedule 40, black-steel and wrought-steel fittings with welded joints.

G. Safety-Relief-Valve Discharge Piping: Copper, Type ACR, annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.

H. Safety-Relief-Valve Discharge Piping: Copper, Type K, annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.

I. Safety-Relief-Valve Discharge Piping:
1. NPS 5/8and Smaller: Copper, Type ACR, annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.
2. NPS 3/4 to NPS 1 and Smaller: Copper, Type K, annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.

3. NPS 1-1/4and Smaller: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with 95-5 tin-antimony soldered joints.
4. NPS 1-1/2 to NPS 2: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with Alloy HB soldered joints.

J. Safety-Relief-Valve Discharge Piping NPS 2 to NPS 4: Schedule 40, black-steel and wrought-steel fittings with welded joints.

3.2 VALVE AND SPECIALTY APPLICATIONS

A. Install diaphragm packless valves in suction and discharge lines of compressor.

B. Install service valves for gage taps at inlet and outlet of hot-gas bypass valves and strainers if they are not an integral part of valves and strainers.

C. Install a check valve at the compressor discharge and a liquid accumulator at the compressor suction connection.

D. Except as otherwise indicated, install diaphragm packless valves on inlet and outlet side of filter dryers.

E. Install a full-sized, three-valve bypass around filter dryers.

F. Install solenoid valves upstream from each expansion valve and hot-gas bypass valve. Install solenoid valves in horizontal lines with coil at top.

G. Install thermostatic expansion valves as close as possible to distributors on evaporators.
1. Install valve so diaphragm case is warmer than bulb.
2. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.
3. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.

H. Install safety relief valves where required by ASME Boiler and Pressure Vessel Code. Pipe safety-relief-valve discharge line to outside according to ASHRAE 15.

I. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.

J. Install strainers upstream from and adjacent to the following unless they are furnished as an integral assembly for device being protected:
1. Solenoid valves.
2. Thermostatic expansion valves.
3. Hot-gas bypass valves.
4. Compressor.

K. Install filter dryers in liquid line between compressor and thermostatic expansion valve, and in the suction line at the compressor.

L. Install receivers sized to accommodate pump-down charge.

M. Install flexible connectors at compressors.

3.3 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

B. Install refrigerant piping according to ASHRAE 15.

C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping adjacent to machines to allow service and maintenance.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Select system components with pressure rating equal to or greater than system operating pressure.

J. Refer to drawings and specifications for solenoid valve controllers, control wiring, and sequence of operation.

K. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

L. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Section 08311 "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.

M. Install refrigerant piping in protective conduit where installed belowground.

N. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.

O. Slope refrigerant piping as follows:

1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
2. Install horizontal suction lines with a uniform slope downward to compressor.
3. Install traps and double risers to entrain oil in vertical runs.
4. Liquid lines may be installed level.

P. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

Q. Before installation of steel refrigerant piping, clean pipe and fittings using the following procedures:

1. Shot blast the interior of piping.
2. Remove coarse particles of dirt and dust by drawing a clean, lintless cloth through tubing by means of a wire or electrician's tape.
3. Draw a clean, lintless cloth saturated with trichloroethylene through the tube or pipe. Continue this procedure until cloth is not discolored by dirt.
4. Draw a clean, lintless cloth, saturated with compressor oil, squeezed dry, through the tube or pipe to remove remaining lint. Inspect tube or pipe visually for remaining dirt and lint.
5. Finally, draw a clean, dry, lintless cloth through the tube or pipe.
6. Safety-relief-valve discharge piping is not required to be cleaned but is required to be open to allow unrestricted flow.

R. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

S. Identify refrigerant piping and valves according to specifications.

T. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified.

U. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified.

V. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified.

3.4 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide), during brazing or welding, to prevent scale formation.

D. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."

1. Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper pipe.
2. Use Type BAg, cadmium-free silver alloy for joining copper with bronze or steel.

F. Threaded Joints: Thread steel pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry-seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Steel pipe can be threaded, but threaded joints must be seal brazed or seal welded.

H. Welded Joints: Construct joints according to AWS D10.12/D10.12M.

I. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.5 HANGERS AND SUPPORTS

A. Hanger, support, and anchor products are specified in Section 23 05 29 "Hangers and Supports for HVAC Piping and Equipment."

B. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
2. Roller hangers and spring hangers for individual horizontal runs 20 feet or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.
5. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

C. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:

1. NPS 1/2: Maximum span, 60 inches; minimum rod size, 1/4 inch.
2. NPS 5/8: Maximum span, 60 inches; minimum rod size, 1/4 inch.
3. NPS 1: Maximum span, 72 inches; minimum rod size, 1/4 inch.
4. NPS 1-1/4: Maximum span, 96 inches; minimum rod size, 3/8 inch.
5. NPS 1-1/2: Maximum span, 96 inches; minimum rod size, 3/8 inch.
6. NPS 2: Maximum span, 96 inches; minimum rod size, 3/8 inch.
7. NPS 2-1/2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
8. NPS 3: Maximum span, 10 feet; minimum rod size, 3/8 inch.
9. NPS 4: Maximum span, 12 feet; minimum rod size, 1/2 inch.

D. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 2: Maximum span, 10 feet; minimum rod size, 3/8 inch.
2. NPS 2-1/2: Maximum span, 11 feet; minimum rod size, 3/8 inch.
3. NPS 3: Maximum span, 12 feet; minimum rod size, 3/8 inch.
4. NPS 4: Maximum span, 14 feet; minimum rod size, 1/2 inch.

E. Support multifloor vertical runs at least at each floor.

3.6 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:
   1. Comply with ASME B31.5, Chapter VI.
   2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
   3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in Part 1 "Performance Requirements" Article.
      a. Fill system with nitrogen to the required test pressure.
      b. System shall maintain test pressure at the manifold gage throughout duration of test.
      c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
      d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

3.7 SYSTEM CHARGING

A. Charge system using the following procedures:
   1. Install core in filter dryers after leak test but before evacuation.
   2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
   3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
   4. Charge system with a new filter-dryer core in charging line.

3.8 ADJUSTING

A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.
B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.
C. Adjust set-point temperature of air-conditioning or chilled-water controllers to the system design temperature.
D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:
   1. Open shutoff valves in condenser water circuit.
   2. Verify that compressor oil level is correct.
   3. Open compressor suction and discharge valves.
   4. Open refrigerant valves except bypass valves that are used for other purposes.
   5. Check open compressor-motor alignment and verify lubrication for motors and bearings.
E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION

SECTION 23 31 13 - METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Double-wall rectangular ducts and fittings.
3. Single-wall round ducts and fittings.
4. Double-wall round ducts and fittings.
5. Sheet metal materials.
6. Duct liner.
7. Sealants and gaskets.
8. Hangers and supports.
9. Seismic-restraint devices.

B. Related Sections:

1. Section 23 05 93 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Section 23 31 16 "Nonmetal Ducts" for fibrous-glass ducts, thermoset fiber-reinforced plastic ducts, thermoplastic ducts, PVC ducts, and concrete ducts.
3. Section 23 33 00 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of the following products:

1. Liners and adhesives.
2. Sealants and gaskets.
3. Seismic-restraint devices.

B. Sustainable Design Submittals:

1. Product Data: For adhesives, indicating VOC content.
2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
3. Product Data: For sealants, indicating VOC content.
4. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.
5. Laboratory Test Reports: For antimicrobial coatings, indicating compliance with requirements for low-emitting materials.

C. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
4. Elevation of top and bottom of ducts.
5. Dimensions of main all duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.

8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment and vibration isolation.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: A single set of plans or BIM model, drawn to scale, showing the items described in this Section, and coordinated with all building trades.

B. Welding certificates.

C. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.
3. AWS D9.1/D9.1M, "Sheet Metal Welding Code," for duct joint and seam welding.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Airstream Surfaces: Surfaces in contact with airstream shall comply with requirements in ASHRAE 62.1.

B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment," and Section 7 - "Construction and System Startup."

C. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

D. Duct Dimensions: Unless otherwise indicated, all duct dimensions indicated on Drawings are inside clear dimensions and do not include insulation or duct wall thickness.

2.2 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

1. Construct ducts of galvanized sheet steel unless otherwise indicated.
2. For ducts exposed to weather, construct of Type 304 stainless steel indicated by manufacturer to be suitable for outdoor installation.

B. Transverse Joints: Fabricate joints in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. For ducts with longest side less than 36 inches, select joint types in accordance with Figure 2-1.
2. For ducts with longest side 36 inches or greater, use flange joint connector Type T-22, T-24, T-24A, T-25a, or T-25b. Factory-fabricated flanged duct connection system may be used if submitted and approved by engineer of record.
3. Where specified for specific applications, all joints shall be welded.

C. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Where specified for specific applications, all joints shall be welded.

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 DOUBLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. Rectangular Ducts: Fabricate ducts with indicated dimensions for clear internal dimensions of the inner duct.

B. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

1. Construct ducts of galvanized sheet steel unless otherwise indicated.

2. For ducts exposed to weather, construct outer duct of Type 304 stainless steel indicated by manufacturer to be suitable for outdoor installation.

C. Transverse Joints: Select joint types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. For ducts with longest side less than 36 inches, select joint types in accordance with Figure 2-1.

2. For ducts with longest side 36 inches or greater, use flange joint connector Type T-22, T-24, T-24A, T-25a, or T-25b. Factory-fabricated flanged duct connection system may be used if submitted and approved by engineer of record.

3. Where specified for specific applications, all joints shall be welded.

D. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Where specified for specific applications, all joints shall be welded.

E. Interstitial Insulation: Fibrous-glass liner complying with ASTM C1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Maximum Thermal Conductivity: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.

2. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.

3. Coat insulation with antimicrobial coating.

4. Cover insulation with polyester film complying with UL 181, Class 1.

F. Interstitial Insulation: Flexible elastomeric duct liner complying with ASTM C534/C534M, Type II for sheet materials, and with NFPA 90A or NFPA 90B.

1. Maximum Thermal Conductivity: 0.25 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.

2.4 SINGLE-WALL ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

1. Construct ducts of galvanized sheet steel unless otherwise indicated.

2. For ducts exposed to weather, construct of Type 304 stainless steel indicated by manufacturer to be suitable for outdoor installation.

B. Transverse Joints: Select joint types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

C. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
2. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.

D. Tees and Laterals: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.5 DOUBLE-WALL ROUND DUCTS AND FITTINGS

A. Round: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension) of the inner duct.

1. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 3, "Round, Oval, and Flexible Duct," based on static-pressure class unless otherwise indicated.
    a. Construct ducts of galvanized sheet steel unless otherwise indicated.
    b. For ducts exposed to weather, construct outer duct of Type 304 stainless steel indicated by manufacturer to be suitable for outdoor installation.
2. Transverse Joints: Select joint types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
    a. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.
3. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
    a. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
    b. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.
4. Tees and Laterals: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Inner Duct: solid galvanized sheet steel.

C. Interstitial Insulation: Fibrous-glass liner complying with ASTM C1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Maximum Thermal Conductivity: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
2. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
3. Coat insulation with antimicrobial coating.
4. Cover insulation with polyester film complying with UL 181, Class 1.

D. Interstitial Insulation: Flexible elastomeric duct liner complying with ASTM C534/C534M, Type II for sheet materials, and with NFPA 90A or NFPA 90B.

1. Maximum Thermal Conductivity: 0.25 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.

2.6 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A653/A653M.

1. Galvanized Coating Designation: G60.
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. PVC-Coated, Galvanized Sheet Steel: Comply with ASTM A653/A653M.

1. Galvanized Coating Designation: G60.

D. Carbon-Steel Sheets: Comply with ASTM A1008/A1008M, with oiled, matte finish for exposed ducts.

E. Stainless-Steel Sheets: Comply with ASTM A480/A480M, Type 304 or 316, as indicated in "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in "Duct Schedule" Article.

F. Aluminum Sheets: Comply with ASTM B209 Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.

G. Reinforcement Shapes and Plates: ASTM A36/A36M, steel plates, shapes, and bars; black and galvanized.

1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

H. Tie Rods: Galvanized steel, 1/4-inch-minimum diameter for lengths 36 inches or less; 3/8-inch-minimum diameter for lengths longer than 36 inches.

2.7 DUCT LINER

A. Fibrous-Glass Duct Liner: Comply with ASTM C1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Maximum Thermal Conductivity:
   a. Type I, Flexible: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
   b. Type II, Rigid: 0.23 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
2. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
3. Solvent-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C916.
   a. Adhesive shall have a VOC content of 80 g/L or less.
   b. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. Flexible Elastomeric Duct Liner: Preformed, cellular, closed-cell, sheet materials complying with ASTM C534/C534M, Type II, Grade 1; and with NFPA 90A or NFPA 90B.

1. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested in accordance with UL 723; certified by an NRTL.

2. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.

a. Adhesive shall have a VOC content of 80 g/L or less.

b. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

C. Fiberglass-Free Duct Liner: Made from partially recycled cotton or polyester products and containing no fiberglass. Airstream surface overlaid with fire-resistant facing to prevent surface erosion by airstream, complying with NFPA 90A or NFPA 90B. Treat natural-fiber products with antimicrobial coating.

1. Maximum Thermal Conductivity: 0.24 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature when tested in accordance with ASTM C518.

2. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested in accordance with ASTM E84; certified by an NRTL.

3. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.

a. Adhesive shall have a VOC content of 80 g/L or less.

b. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

D. Insulation Pins and Washers:

1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch-diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.

2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick aluminum; with beveled edge sized as required to hold insulation securely in place, but not less than 1-1/2 inches in diameter.

E. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 7-11, "Flexible Duct Liner Installation."

1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.

2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.

3. Butt transverse joints without gaps, and coat joint with adhesive.

4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.

5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.

6. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpmor greater.

7. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.

8. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:
   a. Fan discharges.
   b. Intervals of lined duct preceding unlined duct.
   c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm or where indicated.
9. Secure insulation between perforated sheet metal inner duct of same thickness as specified for outer shell. Use mechanical fasteners that maintain inner duct at uniform distance from outer shell without compressing insulation.
   a. Sheet Metal Inner Duct Perforations: 3/32-inch diameter, with an overall open area of 23 percent.
10. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.8 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested in accordance with UL 723; certified by an NRTL.

B. Two-Part Tape Sealing System:
1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
2. Tape Width: 6 inches.
3. Sealant: Modified styrene acrylic.
4. Water resistant.
5. Mold and mildew resistant.
6. Maximum Static-Pressure Class: 10 inch wg, positive and negative.
7. Service: Indoor and outdoor.
8. Service Temperature: Minus 40 to plus 200 deg F.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
10. Sealant shall have a VOC content of 420 g/L or less.
11. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

C. Water-Based Joint and Seam Sealant:
1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10 inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Solvent-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Base: Synthetic rubber resin.
3. Solvent: Toluene and heptane.
4. Solids Content: Minimum 60 percent.
5. Shore A Hardness: Minimum 60.
6. Water resistant.
7. Mold and mildew resistant.
8. Sealant shall have a VOC content of 420 g/L or less.
9. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
10. Maximum Static-Pressure Class: 10-inch wg, positive or negative.
11. Service: Indoor or outdoor.
12. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

E. Flanged Joint Sealant: Comply with ASTM C920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.
6. Sealant shall have a VOC content of 420 g/L or less.
7. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

F. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

G. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for10-inch wg static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.9 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Galvanized-steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A603.

E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A492.

F. Steel Cable End Connections: Galvanized-steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

H. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

2.10 SEISMIC-RESTRAINT DEVICES

A. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an evaluation service member of the ICC Evaluation Service.
   1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

B. Channel Support System: Shop- or field-fabricated support assembly made of slotted steel channels rated in tension, compression, and torsion forces and with accessories for attachment to braced component at one end and to building structure at the other end. Include matching components and corrosion-resistant coating.

C. Restraint Cables: ASTM A603, galvanized or ASTM A492, stainless-steel cables with end connections made of galvanized-steel assemblies with brackets, swivel, and bolts designed for restraining cable service; and with an automatic-locking and clamping device or double-cable clips.

D. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.

E. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested in accordance with ASTM E488/E488M.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and coordination drawings.

B. Install ducts in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install ducts in maximum practical lengths with fewest possible joints.

D. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

E. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

F. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

G. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

H. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

I. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

J. Install fire, combination fire/smoke, and smoke dampers where indicated on Drawings and as required by code, and by local authorities having jurisdiction. Comply with requirements in Section 23 33 00 "Air Duct Accessories" for fire and smoke dampers and specific installation requirements of the damper UL listing.

K. Install heating coils, cooling coils, air filters, dampers, and all other duct-mounted accessories in air ducts where indicated on Drawings.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials both before and after installation. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

M. Elbows: Use long-radius elbows wherever they fit.

1. Fabricate 90-degree rectangular mitered elbows to include turning vanes.

2. Fabricate 90-degree round elbows with a minimum of three segments for 12 inches and smaller and a minimum of five segments for 14 inches and larger.

N. Branch Connections: Use lateral or conical branch connections.

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 ADDITIONAL INSTALLATION REQUIREMENTS FOR TYPE 1 COMMERCIAL KITCHEN GREASE HOOD EXHAUST DUCT

A. Install ducts in accordance with NFPA 96, "Ventilation Control and Fire Protection of Commercial Cooking Operation"; SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; and SMACNA's "Kitchen Ventilation Systems and Food Service Equipment Fabrication and Installation Guidelines" unless otherwise indicated.

B. Install all ducts without dips and traps that may hold grease, and sloped a minimum of 2 percent to drain grease back to the hood.

C. All joints shall be welded and shall be telescoping, bell, or flange joint as per NFPA 96.

D. Install fire-rated access panel assemblies at each change in direction and at maximum intervals of 20 feet in horizontal ducts, and at every floor for vertical ducts, or as indicated on Drawings.

E. Do not penetrate fire-rated assemblies except as allowed by applicable building codes and authorities having jurisdiction.

3.4 ADDITIONAL INSTALLATION REQUIREMENTS FOR EXHAUST DUCTS SERVING COMMERCIAL DISHWASHERS AND OTHER HIGH-HUMIDITY LOCATIONS

A. Install dishwasher exhaust ducts and other exhaust ducts from wet, high-humidity locations without dips and traps that may hold water. Slope ducts a minimum of 2 percent back to dishwasher or toward drain.

B. Provide a drain pocket at each low point and at the base of each riser with a 1-inchtrapped copper drain from each drain pocket to open site floor drain.

C. Minimize number of transverse seams.

D. Do not locate longitudinal seams on bottom of duct.

3.5 DUCTWORK EXPOSED TO WEATHER

A. All external joints are to be welded have secure watertight mechanical connections. Seal all openings to provide weatherproof construction.

B. Construct ductwork to resist external loads of wind, snow, ice, and other effects of weather. Provide necessary supporting structures.

C. Single Wall:

1. Ductwork shall be Type 304 stainless steel.

a. If duct outer surface is uninsulated, protect outer surface with suitable paint. Paint materials and application requirements are specified in Section 09 91 13 "Exterior Painting."

2. Where ducts have external insulation, provide weatherproof aluminum jacket. See Section 23 07 13 "Duct Insulation."

D. Double Wall:

1. Ductwork shall comply with requirements in "Double-Wall Rectangular Ducts and Fittings" or "Double-Wall Round Ducts and Fittings" Article.

2. Ductwork outer wall shall be Type 304 stainless steel indicated by manufacturer to be suitable for outdoor installation.

3. Provide interstitial insulation.

3.6 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Seal ducts at a minimum to the following seal classes in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2. Outdoor, Supply-Air Ducts: Seal Class A.

3. Outdoor, Exhaust Ducts: Seal Class C.

4. Outdoor, Return-Air Ducts: Seal Class C.

5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.

6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.

7. Unconditioned Space, Exhaust Ducts: Seal Class C.

8. Unconditioned Space, Return-Air Ducts: Seal Class B.

9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.

10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class B.

11. Conditioned Space, Exhaust Ducts: Seal Class B.

12. Conditioned Space, Return-Air Ducts: Seal Class C.

3.7 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.

2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.

3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.

4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.

5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.8 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Section 23 33 00 "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.9 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting."

3.10 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Leakage Tests:

1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.

2. Test the following systems:

a. Ducts with a Pressure Class Higher Than 3-Inch wg: Test representative duct sections totaling no less than 25 percent of total installed duct area for each designated pressure class.

b. Supply Ducts with a Pressure Class of 2-Inch wg or Higher: Test representative duct sections totaling no less than 50 percent of total installed duct area for each designated pressure class.

c. Return Ducts with a Pressure Class of 2-Inch wg or Higher: Test representative duct sections totaling no less than 50 percent of total installed duct area for each designated pressure class.

d. Exhaust Ducts with a Pressure Class of 2-Inch wg or Higher: Test representative duct sections totaling no less than 50 percent of total installed duct area for each designated pressure class.

e. Outdoor-Air Ducts with a Pressure Class of 2-Inch wg or Higher: Test representative duct sections totaling no less than 50 percent of total installed duct area for each designated pressure class.

3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.

4. Testing of each duct section is to be performed with access doors, coils, filters, dampers, and other duct-mounted devices in place as designed. No devices are to be removed or blanked off so as to reduce or prevent additional leakage.

5. Test for leaks before applying external insulation.

6. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.

7. Give seven days' advance notice for testing.

C. Duct System Cleanliness Tests:

1. Visually inspect duct system to ensure that no visible contaminants are present.

2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness in accordance with "Description of Method 3 - NADCA Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."
    a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.

D. Duct system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.11 DUCT CLEANING

A. Clean new duct system(s) before testing, adjusting, and balancing.

B. For cleaning of existing ductwork, see Section 23 01 30.52 "Existing HVAC Air Distribution System Cleaning."

C. Use duct cleaning methodology as indicated in NADCA ACR.

D. Use service openings for entry and inspection.

1. Provide openings with access panels appropriate for duct static-pressure and leakage class at dampers, coils, and any other locations where required for inspection and cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Section 23 33 00 "Air Duct Accessories" for access panels and doors.
2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
3. Remove and reinstall ceiling to gain access during the cleaning process.

E. Particulate Collection and Odor Control:

1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

F. Clean the following components by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).
2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.
5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.
7. Dedicated exhaust and ventilation components and makeup air systems.

G. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.

5. Clean coils and coil drain pans in accordance with NADCA ACR. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide drainage and cleanup for wash-down procedures.
7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents in accordance with manufacturer's written instructions after removal of surface deposits and debris.

3.12 STARTUP

A. Air Balance: Comply with requirements in Section 23 05 93 "Testing, Adjusting, and Balancing for HVAC."

3.13 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:
   1. Fabricate all ducts to achieve SMACNA pressure class, seal class, and leakage class as indicated below.

B. Supply Ducts:
   1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
      a. Pressure Class: Positive 2-inch wg.
      b. Minimum SMACNA Seal Class: A.
      c. SMACNA Leakage Class for Rectangular: 2.
      d. SMACNA Leakage Class for Round and Flat Oval: 2.
   2. Ducts Connected to Constant-Volume Air-Handling Units:
      a. Pressure Class: Positive 2-inch wg.
      b. Minimum SMACNA Seal Class: A.
      c. SMACNA Leakage Class for Rectangular: 2.
      d. SMACNA Leakage Class for Round and Flat Oval: 2.
   3. Ducts Connected to Variable-Air-Volume Air-Handling Units:
      a. Pressure Class: Positive 3-inch wg.
      b. Minimum SMACNA Seal Class: A.
      c. SMACNA Leakage Class for Rectangular: 2.
      d. SMACNA Leakage Class for Round and Flat Oval: 2.
   4. Ducts Connected to Equipment Not Listed Above:
      a. Pressure Class: Positive 2-inch wg.
      b. Minimum SMACNA Seal Class: A.
      c. SMACNA Leakage Class for Rectangular: 2.
      d. SMACNA Leakage Class for Round and Flat Oval: 2.

C. Return Ducts:
   1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
      a. Pressure Class: Positive or negative 1-inch wg.
      b. Minimum SMACNA Seal Class: A.
      c. SMACNA Leakage Class for Rectangular: 2.
      d. SMACNA Leakage Class for Round and Flat Oval: 2.
   2. Ducts Connected to Air-Handling Units Insert equipment:
      a. Pressure Class: Positive or negative 2-inch wg.
      b. Minimum SMACNA Seal Class: A.
      c. SMACNA Leakage Class for Rectangular: 2.
      d. SMACNA Leakage Class for Round and Flat Oval: 2.

3. Ducts Connected to Equipment Not Listed above:
    a. Pressure Class: Positive or negative 2-inch wg.
    b. Minimum SMACNA Seal Class: A.
    c. SMACNA Leakage Class for Rectangular: 2.
    d. SMACNA Leakage Class for Round and Flat Oval: 2.

D. Exhaust Ducts:
1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
    a. Pressure Class: Negative 2-inch wg.
    b. Minimum SMACNA Seal Class: A if negative pressure, and A if positive pressure.
    c. SMACNA Leakage Class for Rectangular: 2.
    d. SMACNA Leakage Class for Round and Flat Oval: 2.
2. Ducts Connected to Air-Handling Units:
    a. Pressure Class: Positive or negative 2-inch wg.
    b. Minimum SMACNA Seal Class: A if negative pressure, and A if positive pressure.
    c. SMACNA Leakage Class for Rectangular: 2.
    d. SMACNA Leakage Class for Round and Flat Oval: 2.
3. Ducts Connected to Commercial Kitchen Hoods: Comply with NFPA 96.
    a. Exposed to View: Type 304, stainless-steel sheet, No. 4 finish.
    b. Concealed: Type 304, stainless-steel sheet, No. 2D finish.
    c. Welded seams and joints.
    d. Pressure Class: Positive or negative 2-inch wg.
    e. Airtight/watertight.
4. Ducts Connected to Dishwashers, Dishwasher Hoods, and Other High-Humidity Locations:
    a. Type 304, stainless-steel sheet.
    b. Exposed to View: No. 4 finish.
    c. Concealed: No. 2D finish.
    d. Welded longitudinal seams; welded or flanged transverse joints with watertight EPDM gaskets.
    e. Pressure Class: Positive or negative 2-inch wg.
    f. Airtight/watertight.
5. Ducts Connected to Fans Exhausting Fume Hood, Laboratory, and Process (ASHRAE 62.1, Class 3 and Class 4) Air:
    a. Type 316, stainless-steel sheet.
        1) Exposed to View: No. 4 finish.
        2) Concealed: No. 2B finish.
    b. Pressure Class: Positive or negative 3-inch wg.
    c. Welded seams and joints.
    d. Airtight/watertight.

E. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:
1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
    a. Pressure Class: Positive or negative 2-inch wg.
    b. Minimum SMACNA Seal Class: A.
    c. SMACNA Leakage Class for Rectangular: 8.
    d. SMACNA Leakage Class for Round and Flat Oval: 8.

2. Ducts Connected to Air-Handling Units:
    a. Pressure Class: Positive or negative 2-inch wg.
    b. Minimum SMACNA Seal Class: A.
    c. SMACNA Leakage Class for Rectangular: 2.
    d. SMACNA Leakage Class for Round and Flat Oval: 2.
3. Ducts Connected to Equipment Not Listed Above:
    a. Pressure Class: Positive or negative 2-inch wg.
    b. Minimum SMACNA Seal Class: A.
    c. SMACNA Leakage Class for Rectangular: 2.
    d. SMACNA Leakage Class for Round and Flat Oval: 2.

F. Intermediate Reinforcement:
1. Galvanized-Steel Ducts: Galvanized steel.
2. PVC-Coated Ducts:
    a. Exposed to Airstream: Match duct material.
    b. Not Exposed to Airstream: Match duct material.
3. Stainless-Steel Ducts:
    a. Exposed to Airstream: Match duct material.
    b. Not Exposed to Airstream: Match duct material.
4. Aluminum Ducts: Aluminum.

G. Liner:
1. Supply-Air Ducts: Fibrous glass, Type I, 1 inch(es thick.
2. Return-Air Ducts: Fibrous glass, Type I, 1 inch(es thick.
3. Exhaust-Air Ducts: Fibrous glass, Type I, inch(es thick.
4. Supply Fan Plenums: Fibrous glass, Type II, 1 inch(es thick.
5. Return- and Exhaust-Fan Plenums: Fibrous glass, Type II, 2 inches thick.
6. Transfer Ducts: Fibrous glass, Type I, 1 inch(es thick.

H. Double-Wall Duct Interstitial Insulation:
1. Supply-Air Ducts: 1-1/2 inches thick.
2. Return-Air Ducts: 1-1/2 inches thick.
3. Exhaust-Air Ducts: 1 inch thick.

I. Elbow Configuration:
1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
    a. Velocity 1000 fpm or Lower:
        1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
        2) Mitered Type RE 4 without vanes.
    b. Velocity 1000 to 1500 fpm:
        1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
        2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
        3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
    c. Velocity 1500 fpm or Higher:
        1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
        2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.

3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
   a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
   b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
   c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."
   a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
      1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
      2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
      3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
      4) Radius-to Diameter Ratio: 1.5.
   b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
   c. Round Elbows, 14 Inches and Larger in Diameter: Welded.

J. Branch Configuration:
1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."
   a. Rectangular Main to Rectangular Branch: 45-degree entry.
   b. Rectangular Main to Round Branch: Conical spin in.
2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.
   a. Velocity 1000 fpm or Lower: 90-degree tap.
   b. Velocity 1000 to 1500 fpm: Conical tap.
   c. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION

SECTION 23 33 00 - DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Backdraft dampers.
   2. Manual volume control dampers.
   3. Fire and smoke dampers.
   4. Actuators.
   5. Duct silencers.
   6. Turning vanes.
   7. Duct-mounted access doors and panels.
   8. Flexible connectors.
   9. Flexible ducts.
   10. Accessories hardware.

B. Related Sections: The following Sections contain requirements that relate to this Section:
   1. Division 23 Section "Air Outlets and Inlets" for diffusers, registers, and grilles.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Product data including details for materials, dimensions of individual components, profiles, and finishes for the following items:
   1. Backdraft dampers.
   2. Manual volume control dampers.
   3. Fire and smoke dampers.
   4. Duct-mounted access panels and doors.
   5. Flexible ducts.

C. Shop drawings from manufacturer detailing assemblies. Include dimensions, weights, loadings, required clearances, method of field assembly, components, and location and size of each field connection. Detail the following:
   1. Special fittings and volume control damper installation (both manual and automatic) details.
   2. Fire and smoke damper installations, including sleeves and duct-mounted access door and panel installations.

D. Product Certification: Submit certified test data on dynamic insertion loss; self-noise power levels; and airflow performance data, static pressure loss, and dimensions and weights.

1.4 QUALITY ASSURANCE

A. NFPA Compliance: Comply with the following NFPA Standards:
   1. NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."
   2. NFPA 90B, "Standard for the Installation of Warm Air Heating and Air Conditioning Systems."

PART 2 - PRODUCTS

2.1 MANUAL VOLUME CONTROL DAMPERS

A. General: Provide factory-fabricated volume-control dampers, complete with required hardware and accessories. Stiffen damper blades to provide stability under operating conditions. Provide locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for

damper components to seal duct consistent with pressure class. Extend axles full length of damper blades. Provide bearings at both ends of operating shaft.

B. Standard Volume Control Dampers: Multiple- or single-blade, parallel- or opposed-blade design as indicated, standard leakage rating, with linkage outside of air stream, and suitable for horizontal or vertical applications.

1. Steel Frames: Hat-shaped, galvanized-steel channels, minimum of 16 gage, and with mitered and welded corners. Provide frames with flanges where indicated for attaching to walls. Provide flangeless frames where indicated for installation in ducts.
2. Roll-Formed Steel Blades: 16-gage galvanized steel.
3. Blade Axles: Galvanized steel.
4. Tie Bars and Brackets: Galvanized steel.

2.2 FIRE DAMPERS

A. General: UL labeled according to UL Standard 555 "Standard for Fire Dampers." Refer to Fire Damper Schedule at the end of this Section.

B. Fire Rating: 1-1/2 or 3 hours, as indicated.

C. Frame: Type B; fabricated with roll-formed, 21-gage, galvanized-steel; with mitered and interlocking corners.

D. Mounting Sleeve: Factory-installed or field-installed galvanized steel.

1. Minimum Thickness: 0.056-inch (16-gage) or 0.138-inch (10-gage) thick as indicated, and length to suit application.
2. Exceptions: Omit sleeve where damper frame width permits direct attachment of perimeter mounting angles on each side of the wall or floor, and thickness of damper frame meets sleeve requirements.

E. Mounting Orientation: Vertical or horizontal as indicated.

F. Blades: Roll-formed, interlocking, 21-gage galvanized steel. In place of interlocking blades, provide full-length, 21-gage, galvanized-steel blade connectors.

G. Horizontal Dampers: Include a blade lock and stainless steel negator closure spring.

H. Fusible Link: Replaceable, 165 deg F rated.

2.3 CEILING FIRE DAMPERS

A. General: UL listed and labeled; comply with the construction details for the tested floor/roof-ceiling assemblies as indicated in the UL Fire Resistance Directory.

B. Frame: 20-gage, rectangular or round, galvanized steel; style to suit ceiling construction.

C. Blades: 22-gage galvanized steel with nonasbestos refractory insulation.

D. Fusible Link: Replaceable, 165 deg F rated.

2.4 TURNING VANES

A. Manufactured Turning Vanes: Fabricate of 1-1/2-inch-wide, curved blades set at 3/4 inch on center, support with bars perpendicular to blades set at 2 inches on center, and set into side strips suitable for mounting in ducts.

2.5 DUCT-MOUNTED ACCESS DOORS AND PANELS

A. General: Refer to the Access Door Materials Schedule at the end of this Section for frame and door thickness, number of hinges and locks, and location of locks. Provide construction and airtightness suitable for duct pressure class.

B. Frame: Galvanized sheet steel. Provide with bend-over tabs and foam gaskets.

C. Door: Double-wall, galvanized sheet metal construction with insulation fill and thickness, number of hinges and locks as indicated for duct pressure class. Provide vision panel where indicated. Provide 1-inch by 1-inch butt hinge or piano hinge and cam latches.

D. Seal around frame attachment to duct and door to frame with neoprene or foam rubber seals.

E. Insulation: 1-inch thick fiber glass or polystyrene foam board.

2.6 FLEXIBLE CONNECTORS

A. General: Flame-retarded or noncombustible fabrics, coatings, and adhesives complying with UL Standard 181, Class 1.

B. Standard Metal-Edged Connectors: Factory-fabricated with a strip of fabric 3-1/2 inches wide attached to 2 strips of 2-3/4-inch-wide, 24-gage, galvanized sheet steel or 0.032-gage aluminum sheets. Select metal compatible with connected duct system. Fold and crimp metal edge strips onto fabric as illustrated in SMACNA HVAC Duct Standard, 1st Edition, Figure 2-19.

C. Conventional, Indoor System Flexible Connectors Fabric: Glass fabric double coated with polychloroprene.

1. Minimum Weight: 26 oz. per sq yd.
2. Tensile Strength: 480 lb per inch in the warp and 360 lb per inch in the filling.

F. Conventional, Outdoor System Flexible Connectors Fabric: Glass fabric double coated with Du Pont's HYPALON or other synthetic-rubber weatherproof coating resistant to the sun's ultraviolet rays and ozone environment.

1. Minimum Weight: 26 oz. per sq yd.
2. Tensile Strength: 530 lb per inch in the warp and 440 lb per inch in the filling.

2.7 FLEXIBLE DUCTS

A. General: Comply with UL 181, Class 1.

B. Flexible Ducts - Insulated: Factory-fabricated, insulated, round duct, with an outer jacket enclosing 1-1/2-inch-thick, glass fiber insulation around a continuous inner liner.

1. Reinforcement: Steel-wire helix encapsulated in the inner liner.
2. Outer Jacket: Polyethylene film.
3. Inner Liner: Polyethylene film.

2.8 ACCESSORIES HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket and a flat mounting gasket. Size to allow insertion of pitot tube and other testing instruments and provide in length to suit duct insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of duct accessories. Do not proceed with installation until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Install duct accessories according to manufacturer's installation instructions and applicable portions of details of construction as shown in SMACNA standards.

B. Install volume control dampers in lined duct with methods to avoid damage to liner and to avoid erosion of duct liner.

C. Provide test holes at fan inlet and outlet and elsewhere as indicated.

D. Install fire and smoke dampers according to the manufacturer's UL-approved printed instructions.

E. Install fusible links in fire dampers.

F. Label access doors according to Division 23.

3.3 ADJUSTING

A. Adjust duct accessories for proper settings.

B. Adjust fire and smoke dampers for proper action.

C. Final positioning of manual dampers is specified in Division 23 Section "Testing, Adjusting, and Balancing."

ACCESS DOOR MATERIALS SCHEDULE

DUCT PRESSURE CLASS	DOOR SIZE INCHES	NUMBER OF HINGES	NUMBER LOCKS	METAL GAGE FRAME	DOOR	BACK
2 INCHES & LESS	12X12	2	1-S	24	26	26
	16x20	2	2-S	22	24	26
	24X24	3	2-S	22	22	26

S: SIDE
T: TOP
B: BOTTOM

END OF SECTION

SECTION 23 37 13 - AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK

A. Extent of air outlets and inlets work is indicated by drawings and schedules, and by requirements of this section.

B. Types of outlets and inlets required for project include the following:

1. Ceiling air diffusers.
2. Wall registers and grilles.
3. Louvers.

C. Refer to other Division-23 sections for ductwork and duct accessories required in conjunction with air outlets and inlets; not work of this section.

D. Refer to other Division-23 sections for balancing of air outlets and inlets; not work of this section.

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of air outlets and inlets of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Codes and Standards:

1. ARI Compliance: Test and rate air outlets and inlets in accordance with ARI 650 "Standard for Air Outlets and Inlets".
2. AMCA Compliance: Test and rate louvers in accordance with AMCA 500 "Test Method for Louvers, Dampers and Shutters".
3. AMCA Seal: Provide louvers bearing AMCA Certified Rating Seal.
4. NFPA Compliance: Install air outlets and inlets in accordance with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems".

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data for air outlets and inlets including the following:

1. Schedule of air outlets and inlets indicating drawing designation, room location, number furnished, model number, size, and accessories furnished.
2. Data sheet for each type of air outlet and inlet, and accessory furnished; indicating construction, finish, and mounting details.
3. Performance data for each type of air outlet and inlet furnished, including aspiration ability, temperature and velocity traverses; throw and drop; and noise criteria ratings. Indicate selections on data.

B. Shop Drawings: Submit manufacturer's assembly-type shop drawing for each type of air outlet and inlet, indicating materials and methods of assembly of components.

C. Maintenance Data: Submit maintenance data, including cleaning instructions for finishes, and spare parts lists. Include this data, product data, and shop drawings in maintenance manuals; in accordance with requirements of Division 1.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver air outlets and inlets wrapped in factory-fabricated fiber-board type containers. Identify on outside of container type of outlet or inlet and location to be installed. Avoid crushing or bending and prevent dirt and debris from entering and settling in devices.

B. Store air outlets and inlets in original cartons and protect from weather and construction work traffic. Where possible, store indoors; when necessary to store outdoors, store above grade and enclose with waterproof wrapping.

PART 2 - PRODUCTS

2.1 CEILING AIR DIFFUSERS

A. General: Except as otherwise indicated, provide manufacturer's standard ceiling air diffusers where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.

B. Performance: Provide ceiling air diffusers that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device as listed in manufacturer's current data.

C. Ceiling Compatibility: Provide diffusers with border styles that are compatible with adjacent ceiling systems, and that are specifically manufactured to fit into ceiling module with accurate fit and adequate support. Refer to general construction drawings and specifications for types of ceiling systems which will contain each type of ceiling air diffuser.

D. Types: Provide ceiling diffusers of type, capacity, and with accessories and finishes as listed on diffuser schedule. The following requirements shall apply to nomenclature indicated on schedule.

1. Diffuser Faces:
    a. Round (RD): Round housing, core of concentric rings, round duct connection.
    b. Square: Square housing, core of square concentric louvers, square or round duct connection.
    c. Rectangular: Rectangular housing, core of rectangular concentric louvers, square or round duct connection.
    d. Panel: Square or rectangular housing extended to form a panel to fit in ceiling system module, core of square or rectangular concentric louvers, square or round duct connection.
    e. Perforated: Round, square, or rectangular housing covered with removable perforated panel in frame. Conceal air pattern devices above panel.
    f. Linear: Extruded aluminum continuous slot, single or multiple.
2. Diffuser Mountings:
    a. Stepped-Down: Diffuser housing below ceiling with perimeter flange and gasket to seal against ceiling construction.
    b. Flush: Diffuser housing above ceiling surface with flush perimeter flange and gasket to seal against ceiling.
    c. Lay-In: Diffuser housing sized to fit between ceiling exposed suspension tee bars and rest on top surface of tee bar.
3. Diffuser Patterns:
    a. Fixed (FX): Fixed position core with concentric rings or louvers for radial air flow around entire perimeter of diffuser.
    b. 2 Position (2-P): Manual 2-position core with concentric rings or louvers, upper position for horizontal air flow, lower position for vertical air flow.
    c. Adjustable (ADJ): Manual adjustable core with concentric rings or louvers, fully adjustable for horizontal to vertical air flow.
    d. 1 Way (1-W): Fixed louver face for 1-direction air flow, direction indicated on drawings.
    e. 2 Way (2-W): Fixed louver face for 2-direction air flow, directions indicated on drawings.
    f. 3 Way (3-W): Fixed louver face for 3-direction air flow, directions indicated on drawings.
    g. 4 Way (4-W): Fixed louver face for 4-direction air flow, directions indicated on drawings.
4. Diffuser Dampers:
    a. Opposed Blade (O-B): Adjustable opposed blade damper assembly, key operated from face of diffuser.
    b. Butterfly (BTFY): Two semicircular flaps connected to linkage adjustable from face of diffuser with key, and with straightening grid.
    c. Supply and Return (S & R): For supply and return diffusers, butterfly type damper in return neck, annular adjustable dampers in supply duct.

d. Fire Damper (F-D): Combination adjustable opposed blade damper and fusable link fire damper with UL approved link and assembly designed to meet requirements of NFPA 90A.

5. Diffuser Accessories:
   a. Equalizing Deflectors (E-D): Adjustable parallel blades in frame for straightening air flow.
   b. Smudge Ring (S-R): Extension perimeter frame around diffuser, sized so induced air impinges on frame and not on ceiling.
   c. Plaster Ring (P-R): Perimeter ring designed to act as a plaster stop and diffuser anchor.
   d. Extractor (EXTR): Curved blades mounted on adjustable frame to produce air scooping action in duct at diffuser take-off.
6. Diffuser Finishes:
   a. White Enamel (W-E): Semi-gloss white enamel prime finish.

E. Available Manufacturers: Subject to compliance with requirements, manufacturers offering diffusers which may be incorporated in the work include, but are not limited to, the following:
1. Anemostat Products Div.; Dymanics Corp. of America.
2. Cranes Co.; Div. of Wehr Corp.
3. Krueger Mfg. Co.
4. Titus Products Div.; Philips Industries, Inc.
5. Tuttle & Bailey; Div. of Interpace Corp.

2.2 WALL REGISTERS AND GRILLES

A. General: Except as otherwise indicated, provide manufacturer's standard wall registers and grilles where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.

B. Performance: Provide wall registers and grilles that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device and listed in manufacturer's current data.

C. Wall Compatibility: Provide registers and grilles with border styles that are compatible with adjacent wall systems, and that are specifically manufactured to fit into wall construction with accurate fit and adequate support. Refer to general construction drawings and specifications for types of wall construction which will contain each type of wall register and grille.

D. Types: Provide wall registers and grilles of type, capacity, and with accessories and finishes as listed on register and grille schedule.

E. Available Manufacturers: Subject to compliance with requirements, manufacturers offering registers and grilles which may be incorporated in the work include, but are not limited to, the following:
1. Anemostat Products Div.; Dynamics Corp. of America.
2. Carnes Co.; Div. of Wehr Corp.
3. Titus Products Div.; Philips Industries, Inc.

2.3 LOUVERS

A. General: Except as otherwise indicated, provide manufacturer's standard louvers where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.

B. Performance: Provide louvers that have minimum free area, and maximum pressure drop of each type as listed in manufacturer's current data, complying with louver schedule.

C. Substrate Compatibility: Provide louvers with frame and sill styles that are compatible with adjacent substrate, and that are specifically manufactured to fit into construction openings with accurate fit and adequate support, for weatherproof installation. Refer to general construction drawings and specifications for types of substrate which will contain each type of louver.

D. Materials: Construct of aluminum extrusions, ASTM B 221, Alloy 6063-T52. Weld units or use stainless steel fasteners.

E. Louver Screens: On inside face of exterior louvers, provide 1/2" square mesh anodized aluminum wire bird screens mounted in removable extruded aluminum frames.

F. Available Manufacturers: Subject to compliance with requirements, manufacturers offering louvers which may be incorporated in the work include, but are not limited to, the following:
   1. Airline Products Co.
   2. Airolite Co.
   3. American Warming & Ventilating Inc.
   4. Arrow United Industries, Inc.
   5. Construction Specialties, Inc.
   6. Dowco Corp.
   7. Industrial Louvers, Inc.
   8. Louvers & Dampers, Inc.
   9. Penn Ventilator Co., Inc.
   10. Ruskin Mfg. Co.
   11. Safe-Air Inc.
   12. Snyder (E.G.) Co., Inc.
   13. Vent Products Co., Inc.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which air outlets and inlets are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install air outlets and inlets in accordance with manufacturer's written instructions and in accordance with recognized industry practices to insure that products serve intended function.

B. Coordinate with other work, including ductwork and duct accessories, as necessary to interface installation of air outlets and inlets with other work.

C. Locate ceiling air diffusers, registers, and grilles, as indicated on general construction "Reflected Ceiling Plans". Unless otherwise indicated, locate units in center of acoustical ceiling module.

3.3 SPARE PARTS

A. Furnish to Owner, with receipt, 3 operating keys for each type of air outlet and inlet that require them.

END OF SECTION