

TOWN OF CANTON ARMORY COMMUNITY CENTER RENOVATION

CONSTRUCTION DOCUMENTS SPECIFICATIONS

November 12, 2025

PROJECT OWNER:

TOWN OF CANTON
85 Summer Street
Canton, NC 28716

PROJECT CONSULTANTS:

STRUCTURAL ENGINEER

FULLER GROUP, LLC
1350 Cleveland St.
Greenville, SC 29607

MEP/FP/SYSTEMS ENGINEERING

REECE NOLAND, & MCEL RATH, INC.
390 Main Street
Canton, NC 28716

KITCHEN CONSULTANT

FOODESIGNASSOCIATES
8303 University Executive Park Drive. St. 410
Charlotte, NC 28262

OWNER CONSULTANT

MCGILL ASSOCIATES, PA.
5400 Trinity Road, Suite 107
Raleigh, NC 27607

**CRAIG
GAULDEN
DAVIS **PBK****

DESIGN OFFICE: 18 Washington Park, Greenville, SC 29601

Date of Issue: November 12, 2025

CGD | PBK Project Number: 23029.00

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SECTION 00 01 07.1 - SEALS PAGE - ARCHITECT

PART 1 GENERAL

1.1 DESIGN PROFESSIONAL - ARCHITECT OF RECORD

Name:

Firm Name: Craig, Gaulden, Davis | PBK

North Carolina Registered Firm License No.:

Firm Address:

19 Washington Park
Greenville, South Carolina 29601

Divisions 1 - 14 Sections except
where indicated as prepared by other
design professionals of record.



INSERT PROFESSIONAL SEAL ABOVE

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

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SECTION 00 01 07.2 - SEALS PAGE - STRUCTURAL

PART 1 GENERAL

1.1 DESIGN PROFESSIONAL - STRUCTURAL ENGINEER OF RECORD

Name: Mark Hudson

Firm Name: Fuller Group Inc

North Carolina Registered Engineering Firm License No.: C-1903

Firm Address:

1350 Cleveland St.

Greenville, South Carolina 29607

Divisions 3, 4 and 5 Sections except
where indicated as prepared by other
design professionals of record.



INSERT PROFESSIONAL SEAL ABOVE

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

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SECTION 00 01 07.3 - SEALS PAGE - MECHANICAL

PART 1 GENERAL

1.1 DESIGN PROFESSIONAL - MECHANICAL ENGINEER OF RECORD

Name:

Firm Name: Reece, Noland. & McElrath, Inc.

North Carolina Registered Engineering Firm License No.:

Firm Address:

390 Main Street

Canton, North Carolina 28716

Divisions 21, 22, and 23 Sections except
where indicated as prepared by other
design professionals of record.



INSERT PROFESSIONAL SEAL ABOVE

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

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SECTION 00 01 07.4 - SEALS PAGE - ELECTRICAL

PART 1 GENERAL

1.1 DESIGN PROFESSIONAL - ELECTRICAL ENGINEER OF RECORD

Name:

Firm Name: Reece, Noland, & McElrath, Inc.

North Carolina Registered Engineering Firm License No.:

Firm Address:

290 Main Street

Canton, North Carolina 28716

Divisions 26, 27 and 28 Sections except
where indicated as prepared by other
design professionals of record.



INSERT PROFESSIONAL SEAL ABOVE

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

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SECTION 00 01 16 - ADVERTISEMENT FOR BIDS

ADVERTISEMENT FOR BIDS TOWN OF CANTON ARMORY COMMUNITY CENTER RENOVATION

Sealed bids for the project entitled **Town of Canton Armory Community Center Renovation** will be received by the **Town of Canton** until **2:00 PM on Thursday, December 18, 2025**. At said place and time, all Bids that have been duly received, will be publicly opened and read aloud. Mailed or delivered bids should be addressed to:

Town Manager: Lisa Stinnett
Canton Town Hall Boardroom
85 Summer Street
Canton, North Carolina 28716

- A. No Submitted bid may be withdrawn after the scheduled closing time for receipt of bids for a period of sixty (60) days.

A Mandatory Pre-Bid Conference is scheduled for Thursday, November 20, 2025 at 11:00 AM at the Town of Canton Historic Armory, 71 Penland Street, Canton, NC 28716. Bids for the project will only be accepted by General Contractor Bidders in attendance at the Pre-Bid Conference. The sign-in list will be shared by addenda. Requests for information may be submitted until 5 p.m. (EDT) on Monday, December 8, 2025, to Kim Poole with Craig Gaulden Davis Architecture via eMail at kpoole@cgdarch.com.

Project Description: Renovation of a 20,000 SF 2-Story 1938 Historic Armory to enhance its resilience against future floods and disasters. Constructed with masonry, steel, and wood, the exterior scope will include replacing the roof, repairing masonry walls, replacing windows and doors, and adding new lighting. The 14,400 SF main level interior renovation will include new masonry walls, refurbished restrooms and kitchen, new resilient finishes, new fire sprinkler system, and new mechanical, electrical, and plumbing systems. The 5,600 SF upper level will mostly remain unchanged and left unoccupied for public use. New mechanical, electrical, and plumbing equipment will be located here with some modifications to infill discarded openings and add new utility access.

Drawings and specifications (Bid Documents) for the project were prepared by Craig Gaulden Davis | PBK, 19 Washington Park, Greenville, SC 29601 (tel. 864-242-0761). Digital copies of Bid Documents may be obtained by contacting Kim Poole via email at kpoole@cgdarch.com.

Each bid shall be accompanied with a cash deposit or certified check drawn on a bank or trust company insured by the FDIC or a Bid Bond prepared on the form of Bid Bond contained in the Bidding Documents or a Surety Company's standard form and property executed by a corporate surety licensed under the laws of North Carolina to execute such bonds. The amount of the bid bond shall be equal to **five (5) percent** of the total of the bid. The bid deposit shall be retained by the Owner if the successful bidder fails to execute the contract or fails to provide the required bonds, as stated above, within ten (10) days after the proper notice of award of the contract.

Bidders must comply with the requirements of the State of North Carolina and be appropriately licensed as a Contractor as provided in General Statutes Chapter 87.

Neither the Owner nor the Architect/Engineer will be responsible for full or partial sets of Bidding Documents, including any Addenda, obtained from any source other than the Owner's representative, Craig, Gaulden Davis | PBK Architects. Each Bidder shall be responsible for the review of all addenda for the project and shall acknowledge the addenda on the bid form.

The Owner reserves the right to reject any and all Bids, to waive informalities, or to reject non-conforming, non-responsive, or conditional bids. The Owner reserves the right to award a

contract to the lowest, responsive, responsible bidder or bidders, taking into consideration quality, performance and time.

All applicable laws, ordinances, and the rules and regulations of all authorities having jurisdiction over construction of the Project shall apply to the contract throughout.

Each Bidder is responsible for inspecting the site and existing building, and for reading and being thoroughly familiar with the Bidding Documents. The failure or omission of any Bidder to do any of the foregoing shall in no way relieve any Bidder from any obligation in respect to the Bid.

The Town of Canton has adopted a "Minority Business Participation Outreach Plan (MBPOP). The goal of the Town of Canton in adopting its Plan is for the expansion of participation by historically underutilized business (HUB) in construction projects as defined in GS 143 – 128.2 (g). Equal access and opportunity to participate in all aspects of construction projects shall be provided to HUB. It is the policy of the Town of Canton to award public building contracts without regard to race, religion, color, creed, national origin, sex, age or disabling condition. Each Bidder shall make a good faith effort and shall document such efforts to utilize minority businesses and comply with the Town of Canton plan.

Bidders must comply with the President's Executive Order No. 11246 as amended, which prohibits discrimination in employment regarding race, creed, color, sex or national origin. Bidders must comply with Title VI of the Civil Rights Act of 1964, the Davis-Bacon Act, the Anti-Kickback Act, the Contract Work Hours Standard Act, and 40 CFR 33.1016, and 40 CFR 60-4.

Lisa Stinnett – Town Manager
Town of Canton

Date:

END OF SECTION

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SECTION 00 11 16 - INVITATION TO BID

Sealed bids for the project entitled **Town of Canton Armory Community Center Renovation** will be received by the **Town of Canton** until **2:00 PM on Thursday, October 16, 2025**. At said place and time, all Bids that have been duly received, will be publicly opened and read aloud. Mailed or delivered bids should be addressed to:

Town Manager: Lisa Stinnett
Canton Town Hall Boardroom
85 Summer Street
Canton, North Carolina 28716

No Submitted bid may be withdrawn after the scheduled closing time for receipt of bids for a period of sixty (60) days.

A Mandatory Pre-Bid Conference is scheduled for Thursday, September 25, at 3:00 PM at the Town of Canton Historic Armory, 71 Penland Street, Canton, NC 28716. Bids for the project will only be accepted by General Contractor Bidders in attendance at the Pre-Bid Conference. The sign-in list will be shared by addenda. Requests for information may be submitted until 5 p.m. (EDT) on Monday, October 6, 2025, to Kim Poole with Craig Gaulden Davis Architecture via eMail at kpoole@cgdarch.com.

Project Description: Renovation of a 20,000 SF 2-Story 1938 Historic Armory to enhance its resilience against future floods and disasters. Constructed with masonry, steel, and wood, the exterior scope will include replacing the roof, repairing masonry walls, replacing windows and doors, and adding new lighting. The 14,400 SF main level interior renovation will include new masonry walls, refurbished restrooms and kitchen, new resilient finishes, new fire sprinkler system, and new mechanical, electrical, and plumbing systems. The 5,600 SF upper level will mostly remain unchanged and left unoccupied for public use. New mechanical, electrical, and plumbing equipment will be located here with some modifications to infill discarded openings and add new utility access.

Drawings and specifications (Bid Documents) for the project were prepared by Craig Gaulden Davis | PBK, 19 Washington Park, Greenville, SC 29601 (tel. 864-242-0761). Digital copies of Bid Documents may be obtained by contacting Kim Poole via email at kpoole@cgdarch.com.

Digital copies of Bid Documents are available for purchase at www.XXXX (need address) for a fee of \$50.00 per set. These documents may also be viewed for free by selecting this project from the "Bids" link and by entering **Quest Project Number XXXXX(need number)**. **For assistance and fee membership registration, contact QuestCDN at (952) 233-1632 or info@questcdn.com.**

Each bid shall be accompanied with a cash deposit or certified check drawn on a bank or trust company insured by the FDIC or a Bid Bond prepared on the form of Bid Bond contained in the Bidding Documents or a Surety Company's standard form and property executed by a corporate surety licensed under the laws of North Carolina to execute such bonds. The amount of the bid bond shall be equal to **five (5) percent** of the total of the bid. The bid deposit shall be retained by the Owner if the successful bidder fails to execute the contract or fails to provide the required bonds, as stated above, within ten (10) days after the proper notice of award of the contract.

Bidders must comply with the requirements of the State of North Carolina and be appropriately licensed as a Contractor as provided in General Statutes Chapter 87.

Neither the Owner nor the Architect/Engineer will be responsible for full or partial sets of Bidding Documents, including any Addenda, obtained from any source other than the Owner's

representative, Craig, Gaulden Davis | PBK Architects. Each Bidder shall be responsible for the review of all addenda for the project and shall acknowledge the addenda on the bid form.

The Owner reserves the right to reject any and all Bids, to waive informalities, or to reject non-conforming, non-responsive, or conditional bids. The Owner reserves the right to award a contract to the lowest, responsive, responsible bidder or bidders, taking into consideration quality, performance and time.

All applicable laws, ordinances, and the rules and regulations of all authorities having jurisdiction over construction of the Project shall apply to the contract throughout.

Each Bidder is responsible for inspecting the site and existing building, and for reading and being thoroughly familiar with the Bidding Documents. The failure or omission of any Bidder to do any of the foregoing shall in no way relieve any Bidder from any obligation in respect to the Bid.

The Town of Canton has adopted a "Minority Business Participation Outreach Plan (MBPOP). The goal of the Town of Canton in adopting its Plan is for the expansion of participation by historically underutilized business (HUB) in construction projects as defined in GS 143 – 128.2 (g). Equal access and opportunity to participate in all aspects of construction projects shall be provided to HUB. It is the policy of the Town of Canton to award public building contracts without regard to race, religion, color, creed, national origin, sex, age or disabling condition. Each Bidder shall make a good faith effort and shall document such efforts to utilize minority businesses and comply with the Town of Canton plan.

Bidders must comply with the President's Executive Order No. 11246 as amended, which prohibits discrimination in employment regarding race, creed, color, sex or national origin. Bidders must comply with Title VI of the Civil Rights Act of 1964, the Davis-Bacon Act, the Anti-Kickback Act, the Contract Work Hours Standard Act, and 40 CFR 33.1016, and 40 CFR 60-4.

Lisa Stinnett – Town Manager
Town of Canton

Date:

END OF SECTION

SECTION 00 21 13 - INSTRUCTIONS TO BIDDERS

PART 1 GENERAL

1.1 COMPLIANCE, BONDING AND INSURANCE

- A. Compliance with Governmental Requirements:
 - 1. The BIDDER covenants and agrees that BIDDER and their agents and employees will comply fully with all applicable federal, state, county, municipal or other governmental laws, executive orders, wage, hour and labor, equal employment opportunity, disadvantaged business enterprises, pollution control, and environmental regulations, applicable national and local codes, and that he shall obtain all necessary permits, pay all required fees and taxes, and otherwise perform these services in a legal manner. Bidder shall indemnify and hold OWNER harmless from any fees, damages, fines or costs of any kind arising out of BIDDER'S failure to comply with such governmental regulations.
 - 2. BIDDER certifies that all materials, equipment, etc., contained in their PROPOSAL meets all OSHA requirements.
 - 3. **This Project is financed in part by a FEMA Grant. The cost for repairs to improve the resilience of the building must be identified on the pay application for FEMA reimbursement. The Architect will work with the awarded contractor to breakout FEMA cost in the schedules for values for FEMA.**
- B. General Bond Requirements:
 - 1. The BID security shall be as specified, only Section 00 43 13 - PROPOSAL BOND, AIA A310™ as referenced within these CONTRACT DOCUMENTS or a Certified Check is acceptable.
 - 2. Section 00 61 13 – PAYMENT BOND, AIA A312™ and Section 00 61 14 – PERFORMANCE BOND, AIA A312™ shall be as specified; only the PAYMENT and PERFORMANCE BONDS as referenced within these CONTRACT DOCUMENTS are acceptable.
- C. Insurance Requirements:
 - 1. Insurance requirements shall be as specified under the AIA Document 101-2017, Exhibit A, Insurance and Bonds, as referenced within these CONTRACT DOCUMENTS.

1.2 EXAMINATION OF CONDITIONS AFFECTING WORK

- A. Prior to submitting a PROPOSAL, each BIDDER shall examine and thoroughly familiarize BIDDER with all existing conditions including all applicable laws, codes, ordinances, rules and regulations that will affect this WORK. BIDDERS shall visit the site, examine the existing conditions, and shall ascertain by any reasonable means all conditions that will in any manner affect the WORK. BIDDERS shall ask the OWNER for any additional information deemed necessary for them to be fully informed as to exactly what is to be expected prior to submitting a PROPOSAL.

1.3 BIDS

- A. Sealed proposals for the construction of the PROJECT generally described will be received until the time and the date stated in Section 00 11 16 - INVITATION TO BID.
- B. The PROPOSAL shall be on Section 00 42 13 - PROPOSAL FORM provided, no other form is acceptable.
- C. The OWNER reserves the right to award on the basis of the Base Bid amount only or the Base Bid and any combination of Alternates.
- D. Alternate Bids may be held for a period of 60 days from Award. The OWNER reserves the right to accept the Alternate Bid amounts within these 60 days and include as part of the CONTRACT.
- E. Due to the allocation of funds, successful BIDDERS will be required to provide a Schedule of Values in a manner acceptable to the OWNER, and in accordance with the CONTRACT DOCUMENTS.
- F. Each BIDDER shall present his PROPOSAL in a sealed opaque envelope.

1. The outside of the envelope shall be identified as follows:

TO:

Town of Canton
85 Summer Street
Canton, North Carolina 28716
Town of Canton

PROPOSAL FOR:

ARMORY COMMUNITY CENTER RENOVATIONS
71 Penland Street

Canton, North Carolina 28716

- 2.

SUBMITTED BY:

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 00 42 13 - PROPOSAL FORM

TO: TOWN OF CANTON
85 SUMMER STREET
CANTON, NC 28716

FROM BIDDER: _____

ADDRESS: _____

PHONE: _____

DATE: _____

1.1 BIDDER

- A. The undersigned, as BIDDER, does hereby declare that, having familiarized himself with the local conditions affecting the cost of the WORK, CONTRACT DOCUMENTS including the PROJECT MANUAL (consisting of BIDDING and CONTRACT Requirements, and the SPECIFICATIONS), and DRAWINGS, and other related CONTRACT DOCUMENTS prepared **Craig Gaulden Davis | PBK**, and titled:

Project Name/Title: **Town of Canton**
ARMORY COMMUNITY CENTER RENOVATION
71 Penland Street
Canton, North Carolina 28716

Dated: _____, 2025

together with all Addenda to such CONTRACT DOCUMENTS as listed herein (Paragraph 1.10), hereby proposes to furnish all materials and labor specified and perform all WORK required in strict accordance with the provisions of CONTRACT DOCUMENTS noted above for the CONTRACT LUMP SUM BID AMOUNT of:

_____ U.S. Dollars.

And _____ Cents.

1.2 ALTERNATES

- A. Refer to Section 01 23 00 - ALTERNATES for alternate(s) to be included in the above CONTRACT LUMP SUM BID AMOUNT.

1. Alternate No. 1: Kitchen Equipment, and Installation of Kitchen Equipment

_____ U.S. Dollars.

And _____ Cents.

2. Alternate No. 2: Removable Flood Barrier System (See Section 10 71 19.16)

_____ U.S. Dollars.

And _____ Cents.

1.3 UNIT PRICES

- A. Refer to Section 01 22 00 UNIT PRICES for unit prices to be included in the above CONTRACT LUMP SUM BID AMOUNT.

1. Replace Wood Decking:

_____ Dollars.

And _____ Cents.

2. Masonry Repairs:

_____ Dollars.

And _____ Cents.

1.4 NON-COLLUSION

- A. The undersigned affirms that in making such PROPOSAL, neither BIDDER nor any company that BIDDER may represent, nor anyone in behalf of BIDDER or their company, directly or indirectly, has entered into any combination, collusion, undertaking or agreement with any other BIDDER or BIDDERS to control the prices of said WORK, or any compact to prevent any other BIDDER or BIDDERS from bidding on said CONTRACT or WORK and further affirms that such PROPOSAL is made without regard or reference to any other BIDDER or PROPOSAL and without any agreement or understanding or combination, either directly or indirectly, with any other person or persons with reference to such bidding in any way or manner whatsoever.

1.5 DOCUMENTS

- A. Each BIDDER agrees that all documents relied upon in making or supporting their PROPOSAL shall be retained in escrow prior to the date the CONTRACT is awarded and preserved and maintained during the course of the WORK until Final Payment is made. The OWNER will have the right to inspect any and all such PROPOSAL Documents and to verify that such PROPOSAL Documents are properly escrowed, in a manner satisfactory to the OWNER, prior to the time of the Award of the CONTRACT, or at any time thereafter during the course of the WORK.

1.6 ACCEPTANCE

- A. The undersigned, when notified of the acceptance of this PROPOSAL, does hereby agree to enter into a CONTRACT and return such signed (executed) CONTRACT to the OWNER along with the fully executed Performance Bond and Payment Bond, with good and sufficient Surety, and furnish the required Certificates of Insurance within fifteen (15) calendar days after the date of Notice of Award and Acceptance.
- B. A preliminary Construction Schedule (based on major items) as required and shall be provided to the ARCHITECT and OWNER by the undersigned within fifteen (15) calendar days from the date of Notice of Award and Acceptance, and shall be in accordance with the provisions of the CONTRACT DOCUMENTS.
- C. The undersigned further agrees that if awarded the CONTRACT they shall commence the WORK within ten (10) calendar days after the date of Notice to Proceed and that he shall achieve SUBSTANTIAL COMPLETION within **three hundred and sixty five (365) calendar days** after Notice to Proceed. **An additional ten (10) calendar days shall be provided for Alternate 1 if accepted.**
- D. The OWNER will issue a Notice to Proceed when all documentation required by the CONTRACT DOCUMENTS has been submitted, accepted and executed by the OWNER.
- E. Should the undersigned fail to achieve SUBSTANTIAL COMPLETION within the time(s) specified in the CONTRACT and the CONTRACT DOCUMENTS, the OWNER may retain the sum of **\$250.00** for each calendar day that the WORK remains incomplete beyond the time limit(s), which

sum shall represent the actual damages which the OWNER will have sustained per day by failure of the undersigned to complete the WORK within the time(s) stipulated, and this sum is not a penalty, being the stipulated damages the OWNER will have sustained in the event of such default by the undersigned.

- F. In submitting this PROPOSAL, it is understood that the right is reserved by the OWNER to waive formalities, technicalities and irregularities and to reject all PROPOSALS. It is agreed that this PROPOSAL may not be withdrawn for a period of sixty (60) days after the opening thereof.
- G. The undersigned attaches hereto a Cashiers Check, or Proposal Bond in the Sum of U.S. Dollars (\$ _____), payable to **Town of Canton**, as required under Section 00 11 16 - INVITATION TO BID (not less than five percent (5%) of the BID amount), and the undersigned agrees, that in case BIDDER fails to fulfill their obligations under the PROPOSAL and CONTRACT, the Town of Canton, may, at their option, determine that the undersigned has abandoned his rights and interests in such PROPOSAL and that the Cashier's Check or Proposal Bond accompanying their PROPOSAL has been forfeited to the Town of Canton, as liquidated damages. Otherwise, the Cashier's Check or Proposal Bond shall be returned to the undersigned upon the execution and return of the CONTRACT and the acceptance of the Bonds and Insurance, or upon rejection of their PROPOSAL.
- H. The undersigned has included the four (4) allowances stipulated in Section 01 21 00, paragraph 3.3 in the lump sum bid on page 1 of this section under 1.1.A.

1.7 ATTACHMENTS

- A. The undersigned affirms that BIDDER has completed, signed and included in their PROPOSAL the following:
 - 1. Section 00 42 13 - PROPOSAL FORM
 - 2. Section 00 43 13 - PROPOSAL BOND (or Cashier's Check)

A PROPOSAL may be considered irregular and may be rejected if it fails to include these fully executed PROPOSAL Documents or if the BIDDER fails to furnish required data.

When a determination has been made to award a CONTRACT to a specific CONTRACTOR, such CONTRACTOR shall, prior to award, furnish such other pertinent information and assurances regarding his own employment policies and practices, as well as those of his proposed subcontractors, as the OWNER, the Secretary of Labor, or the Office of Federal Contract Compliance (OFCC) may require.

The BIDDER shall furnish similar statements executed by each of their first-tier and second-tier subcontractors whose contracts equal ten thousand (\$10,000.00) dollars or more and shall obtain similar compliance by such subcontractors before awarding such subcontracts. No subcontract shall be awarded to any uncomplying subcontractor.

1.8 COMPLETE PROPOSALS

- A. The undersigned affirms that they have completed all blank spaces in Section 00 42 13 - PROPOSAL FORM.

1.9 ADDENDUM

- A. The undersigned acknowledges receipt of the following Addenda:

ADDENDUM NUMBER	DATED
_____	_____
_____	_____
_____	_____

1.10 SIGNATURES

- A. The legal status of the undersigned is: (The BIDDER shall complete appropriate portion of form [1., 2., or 3] and strike out the other two.)

1. A corporation, duly organized and doing business under the laws of the State of _____, for whom, bearing official title of _____, whose signature is affixed to this PROPOSAL, is duly authorized to execute contracts.

If Foreign Corporation (non-North Carolina): Date of qualification _____,

State: _____.

Name and address of Process Agent: _____

2. A partnership, all of the members of which, with addresses are: (Designate general partners as such).

_____.

_____.

_____.

_____.

_____.

_____.

If all partners are non-resident of Florida: Designate name and address of resident agent required for service of process located in North Carolina.

3. An individual, whose signature is affixed to this PROPOSAL. (If non-resident of North Carolina resident agent for the service of process must be designated.):

Dated and signed at _____, on this _____ day of _____, 2025.

NAME OF BIDDER: _____

BY: _____

(Signature)

BUSINESS ADDRESS: _____

1.11 WITNESS

By: _____

(Signature)

By: _____

(Signature)

LICENSING REQUIREMENTS:

The undersigned certifies that the contractor listed below is licensed in full accordance with the laws of the state of North Carolina. The undersigned further certifies that if a license is required by subcontractor(s) to be utilized for any portion of the work, said subcontractor shall be fully licensed in full accordance with the laws of North Carolina.

FEDERAL IDENTIFICAION NUMBER: _____

CONTRACTOR'S CLASSIFICATION AND SUBCLASSIFICATION WITH LIMITATIONS:

North Carolina Contractor's License Number: _____

_____	_____	_____
(CLASSIFICATION)	(SUB-CLASSIFICATION)	(LIMITATIONS)

BID AUTHORIZTION:

(Type or Print Name of Contractor)

(Type Or Print Address)

(Type or Print City, State or Zip Code)

_____ (Type Or Print Phone Number)	_____ (Type or Print Fax Number)
---------------------------------------	-------------------------------------

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

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SECTION 00 43 13 - PROPOSAL BOND

PART 1 GENERAL

1.1 GENERAL

- A. The Proposal Bond executed for this CONTRACT shall be written on AIA Document A310™ - BID BOND, 2010 Edition, as modified.
- B. For AIA documents, refer to AIA for copies of the reference documents.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

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SECTION 00 52 00 - AGREEMENT-GC'S OF THE CONTRACT

PART 1 GENERAL

1.1 GENERAL

- A. The Agreement/General Condition of the Contract executed for this CONTRACT shall be written on AIA Document A101 Standard Form of Agreement Between Owner and Contractor. 2017 Edition, as modified.
- B. AIA Document A101 - Standard Form of AGreement Between Owner and Contractor, 2017 is comprised of the following documents:
 - 1. AIA Document A101, 2017, Standard Form of Agreement Betwwen Owner and contractor.
 - 2. AIA Document A101, 2017, Exhibit A, Insurance and Bonds.
 - 3. AIA Document A201, 2017 General Conditions of the Contact for Construction.
 - 4. Supplemental Conditions of the Contract for Construction.
- C. For AIA documents, refer to AIA for copies of the reference documents.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

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**SUPPLEMENTARY CONDITIONS OF THE
CONTRACT FOR CONSTRUCTION**

GENERAL CONDITIONS:

AIA Document A201, 2017 Edition - General Conditions of the Contract for Construction is part of this contract.

The provisions of the Instructions to Bidders, Supplemental Instructions to Bidders and General Conditions, including Supplementary Conditions of these Specifications shall govern the Work under all Divisions or Sections the same as if incorporated herein.

SUPPLEMENTAL CONDITIONS

The following supplements modify, delete and/or add to the GENERAL CONDITIONS: Where any article, paragraph or subparagraph in the GENERAL CONDITIONS is supplemented by one of the following sentences and/or paragraphs, the provisions of such article, paragraph, or subparagraph shall remain in effect and the supplemental provisions shall be considered as added thereto. When any article, paragraph or subparagraph in the GENERAL CONDITIONS is amended, voided, or superseded by any of the following sentences and paragraphs, the provisions of such article, paragraph or subparagraph not so amended, voided, or superseded shall otherwise remain in effect.

MODIFICATIONS TO A201-2017

ARTICLE 1- GENERAL PROVISIONS

Add the following sentence to Section 1.1.1:

1.1.1 "The form of Agreement shall be AIA Document A101-2017."

Add the following paragraph 1.2.1.1 after paragraph 1.2.1:

1.2.1.1 In the case of conflicts or discrepancies between Drawings and Division 2-49 of the Specifications, or within or among the Contract Documents and not clarified by Addendum, the Architect will determine which takes precedence in accordance with Sections 4.2.11, 4.2.12, and 4.2.13.

ARTICLE 1.6 TRANSMISSIONS OF DATA IN DIGITAL FORM

Add the following paragraphs to Article 1.7:

1.7.1 Should the Owner request the Architect to issue digital documents, the Architect may issue Instruments of Service to the Contractor or if approved to the Contractor's Sub-Contractor once the requesting party has signed a copy of the Architect's Digital Transfer Agreement.

1.7.2 Should Instruments of Service be requested through the Architect for one of the Architect's Consultant's documents, the party requesting such documents may be required to execute a separate "Digital Transfer Agreement" with the Consultant in addition to the Architect's digital transfer agreement for drawings that have been prepared by the Architect.

ARTICLE 2 OWNER

Add the following sentence to paragraph 2.3.1:

2.3.1.1 "Payment of any tap fees shall be the responsibility of the Contractor and shall be included in the Contract Sum".

Add the following statement at the beginning of paragraph 2.3.4:

2.3.4 "To the extent pertinent to the Work"

ARTICLE 3 CONTRACTOR

Add the following paragraph after paragraph 3.2.2:

3.2.2.1 The Contractor shall be responsible for taking steps reasonably necessary to ascertain the nature and location of the Work, and the general and local conditions which may affect the Work, or the cost or time of performance thereof. Any failure by the Contractor to do so will not relieve him of his responsibility for performing the Work in accordance with the Contract Documents without additional compensation from the Owner.

Add the following paragraph 3.2.5 after paragraph 3.2.4:

3.2.5 The Owner is entitled to reimbursement from the Contractor for amounts paid to the Architect for evaluating and responding to the Contractor's requests for information that are not prepared in accordance with the Contract Documents or where the requested information is available to the Contractor from a careful study and comparison of the Contract Documents, field conditions, other Owner-provided information, Contractor-prepared coordination drawings, or prior Project correspondence or documentation. The cost of the additional services of the Architect shall be deducted as a change order from the Contractor's contract sum.

Add the following paragraph 3.2.6 after paragraph 3.2.5:

3.2.6 All reports or notices required to be provided to the Architect and /or Owner by the Contractor shall be in written form and when issued in verbal form due to emergency, the verbal form shall be followed by a confirmation in written form within twenty-four (24) hours of the verbal communication.

Add the following paragraph 3.2.7 after paragraph 3.2.6:

3.2.7 The Contractor shall include monies in his cost of the Work to provide training for the Architect and the Architect's consultants if needed for training associated with using the Contractor's Construction Project Management Software. The Owner is entitled to reimbursement from the Contractor for amounts paid to the Architect and the Architect's Consultant's for their time for such training. The cost of this training shall be deducted as a change order from the Contractor's contract sum.

Add the following sentence to the end of paragraph 3.3.1:

3.3.1 The Contractor has the responsibility to ensure that all Suppliers and Subcontractors on the Project adhere to the Contract Documents and that they order products and /or materials on time, taking into account the construction schedule, current market and delivery conditions.

Add the following sentence to the end of paragraph 3.4.2:

3.4.2 The Owner shall be entitled to reimbursement from the Contractor for amounts paid to the Architect for reviewing the Contractor's proposed substitutions and making agreed-upon changes to the Drawings and Specifications resulting from such substitutions. The cost of the additional services of the Architect shall be deducted as a change order from the Contractor's contract sum.

Add the following paragraph after paragraph 3.10.2:

3.10.2.1 If after the Architect's approval of the Contractor's submittal schedule, should the Architect be required to review a submittal out of sequence from the approved submittal schedule, the Architect may request additional service after notification to the Owner of such request. The cost for this additional service shall be deducted by change order from the Contractor's contract sum.

Add the following paragraph after paragraph 3.12.6:

3.12.6.1 The Contractor shall submit at the completion of the Project, a complete record of all shop drawings and product data, for the Work as required by the Contract Documents. The Contractor's Final Application for Payment will not be approved, until this record and all other required closeout documents complying with the Contract Documents have been received by the Architect.

Add the following paragraph after paragraph 3.12.6.1:

3.12.6.2 The Architect's review of Contractor's submittals will be limited to the review of an initial submittal and one (1) re-submittal. The Owner is entitled to obtain reimbursement from the Contractor for amounts paid to the Architect for evaluation of additional re-submittals. The cost of the additional services of the Architect shall be deducted by change order from the Contractor's contract sum.

Add the following sentence after the first sentence of paragraph 3.15.1:

3.15.1 All materials shall be covered at the end of the workday and secured to prevent movement during windy conditions.

ARTICLE 4 ARCHITECT

Add paragraph 4.2.2.1 after paragraph 4.2.2:

4.2.2.1 The Owner is entitled to reimbursement from the Contractor for amounts paid to the Architect for site visits made necessary by the fault of the Contractor or by defects and deficiencies in the work. The cost of the additional services of the Architect shall be deducted by change order from the Contractor's contract sum.

Add the following paragraph after paragraph 4.2.7:

4.2.7.1 When the review of a shop drawing submittal exceeds more than two reviews by the Architect in conformity with the contractor's approved submittal schedule, this will be reviewed by the Architect as an Additional Service after notification to the Owner. The cost for this additional service shall be deducted by change order from the Contractor's contract amount.

Add the following paragraph after paragraph 4.2.14:

4.2.14.1 Contractor's Requests for Information (RFI) shall be prepared and submitted in accordance with Division 1 "General Requirements" on AIA Documents G716-2004. The Architect will return without action Requests for Information that does not conform to the requirements of the Contract Documents.

Add the following paragraph after paragraph 4.2.14.1:

4.2.15 In the Drawings and Specifications, where the words "as directed," "as required," "as approved," "as permitted" or words of like effect are used, it is to be understood that direction, requirement, approval or permission of the Architect is intended. Similar words, such as "approved," "acceptable," "satisfactory," or words of like importance mean approved by, acceptable to, or satisfactory to the Architect.

ARTICLE 7 CHANGES IN THE WORK

Add the following paragraph after paragraph 7.1.3:

7.1.4 The combined overhead and profit included in the total cost to the Owner for a change in the work shall be based on the following schedule:

.1 For the Prime Contractor, for work performed by the Contractor's own forces, fifteen percent (15%) of the cost.

.2 For each Subcontractor involved, for work performed by that Subcontractor's own forces fifteen percent (15%) of the cost.

.3 For the Prime Contractor, for Work performed by the Contractor's Subcontractor, seven percent (7%) of the amount due the Subcontractor.

.4 For each Subcontractor for work performed by the Subcontractor's Sub-subcontractor, seven percent (7%) of the amount due the Sub-Subcontractor.

.5 In order to facilitate checking of quotations for extras or credits, all proposals, except those so minor that their propriety can be seen by inspection, shall be accompanied by a complete itemization of costs including labor, materials and Subcontracts. Labor and materials shall be itemized in the manner prescribed above. Where major cost items are Subcontracts, they shall be itemized also. In no case shall changes involving over \$1,000.00 be approved without such itemization.

Add the following sentence after paragraph 7.3.2:

7.3.2.1 All Construction Change Directives shall be signed by the Architect and the Owner before the Contractor begins the work covered by the Construction Change Directive.

ARTICLE 8 TIME

Add the following paragraph after paragraph to 8.3.1:

8.3.1.1 No claims for extension of time will be granted when based on delays caused by conditions existing at the time the bids were received and of which the Contractor might be reasonably expected to have knowledge at the time of bidding, or upon delays caused by failure on part of the Contractor to anticipate properly the requirements of the work contracted for as to materials, labor, and equipment. All claims for an extension of time shall be made in accordance with paragraph 15.1.2.

ARTICLE 9 PAYMENTS AND COMPLETION

Add the following statement after the first sentence of paragraph 9.3.1:

9.3.1 The form of Application for Payment, duly notarized, shall be a current edition of AIA Document G702, Application and Certificate for Payment, supported by a current authorized edition of AIA Document G703, Continuation Sheet or in a format approved by the Owner and Architect. If bonding is required on the Project, each application for payment shall include the following certification: "We certify that the surety for this project has been notified of this request and consents to payment of this request" Application shall be notarized and supported by such data substantiating the Contractor's right to payment as the Owner or Architect may require such as copies or requisitions from Subcontractors and material suppliers.

Add the following paragraph after paragraph 9.3.3:

9.3.3.1 Owner shall be entitled to retain (10%) of the amount approved by the Architect for payment in each Application for Payment until the work of the entire Project is fifty percent (50%) complete, at which time the Owner may, at the Owner's discretion, reduce the retainage amount to (5%). In the event the Owner decides to reduce the retainage amount, the Owner's decision may, but is not required, to consider one or more of the following; the Contractor's performance and the anticipated performance; payment by Contractor to subcontractors and /or suppliers; Fiscal solvency of Contractor; quality of Work performed by Contractor; and written concurrence from Contractor's surety and other factors deemed pertinent by the Owner. The Owner reserves the right to reinstate the retainage requirements at any time.

Add the following paragraphs after paragraph 9.3.2:

9.3.2.1 When Applications for Payment includes products stored either on or off the Project site, but not incorporated in the Work, for which no previous payment has been requested, a complete description of such products shall be attached to the Application for Payment. Stored materials or products, which are located off the Project site, shall be stored in a bonded warehouse with the stored products properly tagged and identified for the Project.

9.3.2.2 The Owner's written approval must be obtained before using an off-site storage facility. Storage of materials or products shall not be stored on a supplier or subcontractor's premises unless approved in writing by the Owner. Contractor requesting payment for off-site storage of materials or products shall provide a certificate of insurance for all of the off-site stored materials and or products naming the Owner as the insured.

9.3.2.3 Rental equipment including but not limited to, mobile equipment, pans, forms, scaffolding, compressors, etc., shall not be considered as stored materials.

Add the following paragraphs after 9.8.2:

9.8.2.1 The Work will not be considered for Substantial Completion review until all project systems are operational as designed, all governmental inspections and certificates have been received and posted, designated instructions to the Owner's personnel in the operation of all systems has been completed and all final finishes are in place. The only remaining work shall be minor in nature, such that the Owner could occupy the facility and the remaining completion of items by the Contractor would not interfere with the Owner's normal operations.

9.8.2.2 As an additional condition of Substantial Completion acceptance, the Contractor shall certify that all remaining Work shall be completed within sixty (60) consecutive calendar days following the date of Substantial Completion. The failure on the part of the Contractor and/or his Subcontractors to fulfill the requirement to complete the work within this period of time shall automatically reinstitute any provisions for damages that may exist under the Standard Form of Agreement between the Owner and the Contractor.

9.8.2.3 If all remaining work is not completed within sixty (60) consecutive calendar days following Substantial Completion, the Owner may complete the work, or retain a Contractor to complete the work. All costs for such work shall be charged to the Contractor and may be collected by the Owner in any lawful manner including withholding monies due the Contractor.

Add the following paragraph 9.8.3.2 after paragraph 9.8.3.1:

9.8.3.2 The Architect will perform no more than two (2) inspections to determine whether the Work or a designated portion thereof has attained Substantial Completion in accordance with the Contract Documents. The Owner is entitled to reimbursement from the Contractor for amounts paid to the Architect for any additional inspections. The costs of the additional services of the Architect shall be deducted by change order from the Contractor's contract sum.

Add the following subparagraph 9.8.3.1 after paragraph 9.8.3:

9.8.3.1 The Architect will perform no more than two (2) inspections to determine whether the Work or a designated portion thereof has attained Final Completion in accordance with the Contract Documents. The Owner is entitled to reimbursement from the Contractor for amounts paid to the Architect for any additional inspections. The costs of the additional services of the Architect shall be deducted by change order from the Contractor's contract sum.

Add the following paragraph after paragraph 9.10.2:

9.10.2.1 In addition to the items listed above, the following items must be submitted:

- (a) Contractor's Affidavit of Payment of Debts and Claims, AIA Document G706.
- (b) Contractor's Affidavit of Release of Liens, AIA Document G706A
- (c) Consent of Surety to Final Payment, AIA Document G707.
- (d) Contractor's Release or Waiver of Liens, conditional upon receipt of final payment, submitted in letter form under Contractor's letterhead.
- (e) Separate Releases of Waivers of Liens from Subcontractors and Material and Equipment Suppliers.
- (f) Guarantees and warranties as set forth in Section 3.5 including all other guarantees required in specific Sections of the Specifications.
- (g) Shop drawings, product data, operating and maintenance manuals as set forth in Section 3.12 and these Supplementary Conditions.

Add the following sentence to paragraph 9.10.3:

9.10.3.1 The balance payable under conditions stated shall reflect retainage for three times the value of uncompleted work, as determined by the Architect, but not more than 5% of the contract sum.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

Add the following paragraphs after paragraph 12.2.1:

12.2.1.1 If prior to the date of Substantial completion, the Contractor, a Subcontractor, or anyone for whom either is responsible, uses or damages any portion of the Work, including, without limitation, mechanical, electrical, plumbing, and other building systems, machinery, equipment, or other mechanical devices, the Contractor shall cause such item to be restored to "like new" condition at no expense to the Owner.

12.2.1.2 Warranties and guarantees shall become effective on the date of substantial completion as that date is determined by the Architect. This date shall be the date of Substantial Completion. If in the event the Owner accepts a portion of the Work before final completion of the entire Project, then separate warranties shall be issued for specific portions of the Work, after the Architect has determined these areas are substantially complete and a Certificate of Substantial Completion has been issued.

Add the following paragraph 12.2.2.4 after paragraph 12.2.2.3:

12.2.2.4 Upon request of the Owner and prior to the expiration of one year from the date of Substantial Completion, the Architect will conduct and the Contractor shall attend a meeting with the Owner to review the facility operations and performance.

ARTICLE 13 MISCELLANEOUS PROVISIONS

Add the following paragraph 13.4.7 after paragraph 13.4.6:

13.5.7 Contractor shall be responsible for all coordination and the performance of tests on all fire detection systems.

Add the following paragraphs 13.6, 13.7, and 13.8 after Article 13.5:

13.6 NOTICE OF REQUIREMENT: DRUGFREE WORKPLACE

The Contractor certifies to the Owner that the Contractor will provide a drug-free Workplace, as required by applicable law.

13.7 PROTECTION OF ADJOINING PROPERTY

The Contractor shall be responsible to the Owner for all damages and all injuries to adjoining or near-by lands and /or buildings or to owners thereof and shall replace and make good the same and defend and save the Owner harmless from any and all damages, injuries or claims thereto. Do not allow materials to become airborne and the leave the limits of the site.

13.8 SILT CONTROL

The Contractor shall provide all appropriate barriers and control devices to control silt within the limits of construction of the site and will properly maintain all such devices per all local, state, federal laws and regulations and per good construction practices.

ARTICLE 15 CLAIMS AND DISPUTES

Add the following sentence to paragraph 15.1.2:

15.1.2.1 Failure to provide written notice of a Claim within the time stipulated in this paragraph, a party expressly waives its claim.

Add the following paragraph after paragraph 15.1.6.2:

15.1.6.3 It is anticipated that the Contractor will normally work, at a minimum five (5) 8-hour days per week with Monday through Friday being the normal work hours. The Contract time will not be extended for normal bad weather days. The time in the Contract Documents for project completion includes normal allowance for days on which work cannot be performed out-of-doors. For the purpose of this Contract, the Contractor agrees that they may expect to lose working days due to inclement weather as follows:

January	8 days	July	4 days
February	8 days	August	2 days
March	6 days	September	2 days
April	5 days	October	3 days
May	4 days	November	5 days
June	3 days	December	7 days

The Contractor shall provide such supporting documentation as required by the Owner. Adverse weather day claims are to be calculated only within each month (non-cumulative) and must be submitted with the monthly application for payment. If in any month adverse weather conditions exceed the number of days shown above, the Contractor may submit a request for a time extension only to the extent of the impact on the approved construction schedule. Adverse weather conditions not claimed within the time limits stipulated in this paragraph, shall be considered to be waived by the Contractor. Claims will not be allowed for adverse weather conditions that occur after the scheduled (original or adjusted) date of Substantial Completion. No change in the Contract Sum will be authorized due to an adjustment of Contract Time due to weather.

Add the following paragraph after paragraph 15.1.7.2:

15.1.7.3 If before the expiration of 30 days from the date of execution for this agreement, the Owner obtains by separate agreement and furnishes to the Contractor a similar mutual waiver of all claims from the Architect against the Contractor for consequential damages which the Architect may incur as a result of any act or omission of the Owner or Contractor, then the waiver of consequential damages by the Owner and Contractor contained in this Section 15.1.6 shall be applicable to claims by the Contractor against the Architect.

END OF SUPPLEMENTARY CONDITIONS

SECTION 00 54 00 - AWARD OF CONTRACT

PART 1 GENERAL

1.1 CONSIDERATION OF BIDS

- A. After the Bids are publicly opened and read, they will be compared on the basis of the CONTRACT LUMP SUM Bid Amounts contained therein;
- B. BIDDER'S Bid for any of the following reasons:
 - 1. If the BID is irregular as specified in Subsection 1.07 entitled REJECTION OF BIDS of Section 00 21 13 – INSTRUCTIONS TO BIDDERS.
- C. In addition, until the award of CONTRACT is made, the OWNER reserves the right to reject any or all Bids; waive technicalities, if such waiver is in the best interest of the OWNER and is in conformance with applicable State and local laws or regulations pertaining to the letting of construction contracts; advertise for new Bids; or proceed with the WORK otherwise. All such actions shall promote the OWNER'S best interests.

1.2 AWARD OF CONTRACT

- A. The award of the CONTRACT, if it is awarded, will be to the lowest responsible Bidder whose qualifications indicate the award will be in the best interest of the OWNER and whose Bid complies with all the prescribed requirements.
- B. No award will be made until the OWNER has concluded such investigations as it deems necessary to establish the responsibility, qualifications and financial ability of the Bidders to do the WORK in accordance with the CONTRACT DOCUMENTS to the satisfaction of the OWNER within the time prescribed. The OWNER reserves the right to reject the Bid of any Bidder who does not pass such investigation to the OWNER'S satisfaction. If the CONTRACT is awarded, the OWNER will give the successful BIDDER written notice of the award within sixty (60) days after the opening of the BIDS. Until the final award of the CONTRACT, the OWNER reserves the right to reject any or all BIDS, to waive technicalities and to advertise for new BIDS, or to proceed to do the WORK otherwise when the best interests of the OWNER will be promoted thereby.

1.3 CANCELLATION OF AWARD

- A. The OWNER reserves the right to cancel the award without liability to the BIDDER, except return of Bid guaranty, at any time before a CONTRACT has been fully executed by all parties and is approved by the OWNER in accordance with Subsection 1.07 entitled APPROVAL OF CONTRACT of this Section 00 54 00.

1.4 RETURN OF BID GUARANTEES

- A. As soon as the BIDS have been compared, the OWNER may, at their discretion, return the Cashier's Checks or other collateral accompanying those BIDS which, in their judgment, would not be considered in making the award. When award is made, the successful BIDDER'S collateral and that of the next low BIDDER will be retained until the CONTRACT and BONDS have been executed, after which it will be returned to the BIDDERS. Should the award be delayed more than sixty (60) days after opening of BIDS, all BIDDER'S collateral will be returned, unless such delay is from causes beyond the control of the OWNER.

1.5 REQUIREMENTS OF CONTRACT BONDS

- A. A good and sufficient Performance Bond and Labor and Material Payment Bond on the forms referenced herein, each in the sum of not less than 100 percent of the CONTRACT SUM with a Surety Company satisfactory to the OWNER and licensed to conduct business in the State of Florida, will be required of the CONTRACTOR guaranteeing that the CONTRACT, including the various guarantee periods thereunder, will be faithfully performed; and that CONTRACTOR will promptly make payment to all persons supplying CONTRACTOR labor, materials, supplies and services used directly or indirectly by the CONTRACTOR in the prosecution of the WORK provided for in the CONTRACT.

- B. The Bonds, along with appropriate Power of Attorney, shall be executed and delivered to OWNER, but in no event shall these documents be delivered to the OWNER later than 15 calendar days from the date of Notice of Award and Acceptance, simultaneously with CONTRACTOR'S execution of the CONTRACT. **The CONTRACTOR shall record the Payment and Performance Bonds in the public records of Haywood County, North Carolina and deliver to the OWNER proof of recording prior to commencing any WORK under the CONTRACT.** If, at any time after the execution of the CONTRACT and the CONTRACT Bonds as above required, OWNER shall reasonably deem the Surety or Sureties upon such Bond or Bonds to be unsatisfactory, or if, for any reasons, such Bond or Bonds ceases to be adequate to cover the performance of the WORK or prompt payment as above specified, CONTRACTOR shall, at their expense within 5 days written notice from the OWNER to do so, furnish additional Bond or Bonds in such form and amount and with such Surety or Sureties as shall be satisfactory to the OWNER. In such event, no further payment to the CONTRACTOR shall be deemed due under the CONTRACT until such new or additional Bond or Bonds are furnished in a manner and form satisfactory to the OWNER.

1.6 EXECUTION OF CONTRACT

- A. The successful BIDDER shall sign (execute) the necessary agreements for entering into the CONTRACT and return such signed CONTRACT to the OWNER, along with the fully executed Surety Bond or Bonds specified and along with required Insurance Certificates, within 15 calendar days from the date of the Notice of Award and Acceptance by the OWNER. If the CONTRACT is mailed, special handling is recommended.

1.7 APPROVAL OF CONTRACT

- A. Upon receipt of the required Insurance Certificates, CONTRACT and CONTRACT Bonds that have been executed by the successful BIDDER, the OWNER shall review, accept and complete the execution of the CONTRACT in accordance with local laws or ordinances, and return the fully executed CONTRACT to the CONTRACTOR. No Contract is binding upon the OWNER until it has been executed by the OWNER and delivered to the CONTRACTOR.

1.8 FAILURE TO EXECUTE CONTRACT

- A. Failure of the successful BIDDER to execute the CONTRACT and furnish acceptable Insurance Certificates, Surety Bond or Bonds within the 15 calendar days after the date of Notice of Award and Acceptance shall be just cause for cancellation of the Award and forfeiture of the Bid guaranty, not as a penalty, but as liquidation of damages to the OWNER. Award may then be made to the next best qualified, responsible BIDDER, or the WORK re-advertised, or handled as the OWNER may elect.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 00 61 13 - PERFORMANCE BONDS

PART 1 GENERAL

1.1 PERFORMANCE BOND

- A. The Performance Bond executed for this CONTRACT shall be written on AIA Document A312™ - PERFORMANCE BOND, 2010 Edition, as modified.
- B. For AIA documents, refer to AIA for copies of the reference documents.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

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SECTION 00 61 14 - PAYMENT BOND

PART 1 GENERAL

1.1 PAYMENT BOND

- A. The Payment Bond executed for this CONTRACT shall be written on AIA Document A312™ - PAYMENT BOND, 2010 Edition, as modified.
- B. A "Sample" document is attached for information only.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

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SECTION 01 10 00 - SUMMARY

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

- A. Requirements including, but not limited to:
 - 1. Project information.
 - 2. Work covered by Contract Documents.
 - 3. Owner-furnished Construction Manager installed +products.
 - 4. Type of Contract.
 - 5. Work by Town of Canton and under separate contracts.
 - 6. Access to site.
 - 7. Coordination with occupants.
 - 8. Work restrictions.
 - 9. Construction and sequencing scheduling.
 - 10. Protection of work and adjacent property.
 - 11. Owner occupancy.
 - 12. Specification and Drawing conventions.
 - 13. Construction Schedule.

1.3 PROJECT INFORMATION

- A. Project Name: Armory Community Center Renovation
- B. Project Location:
 - 71 Penland St. , .
 - Canton, North Carolina
- C. Town of Canton: Town of Canton.
- D. Architect: Craig Gaulden Davis | PBK
- E. Consultants:
 - 1. Structural Engineer: Fuller Group.
 - 2. Mechanical, Plumbing, Fire Protection and Electrical: Reece, Nolnd & McElrath, Inc.
 - 3. Food Service Consultants: Foodesign Associates.
 - 4. Owner's FEMA Consultant: McGill Associates, P.A.
 - 5. Project Description:
 - a. Project Description: Renovation of a 20,000 SF 2-Story 1938 Historic Armory to enhance its resilience against future floods and disasters. Constructed with masonry, steel, and wood, the exterior scope will include replacing the roof, repairing masonry walls, replacing windows and doors, and adding new lighting. The 14,400 SF main level interior renovation will include new masonry walls, refurbished restrooms and kitchen, new resilient finishes, new fire sprinkler system, and new mechanical, electrical, and plumbing systems. The 5,600 SF upper level will mostly remain unchanged and left unoccupied for public use. New mechanical, electrical, and plumbing equipment will be located here with some modifications to infill discarded openings and add new utility access.

1.4 WORK COVERED BY THE CONTRACT DOCUMENTS

- A. Contract Documents: Contract documents are defined in the General Conditions of the Contract, and include the following:

1. Drawings as listed on Index.
2. Specification Sections as listed on Table of Contents in Project Manual.
3. All addenda issued prior to Bid Opening

1.5 TYPE OF CONTRACT

- A. Project will be constructed under a AIA Document A101 - Standard Form of Agreement Between Owner and Contractor Where the Basis of Payment is a Stipulated Sum.

1.6 WORK BY OWNER AND UNDER SEPARATE CONTRACTS

- A. Cooperate fully with Town of Canton so Work may be carried out smoothly, without interfering with or delaying the work or work by Town of Canton. Coordinate the Work with Work performed by Town of Canton.
- B. Town of Canton reserves the right to let separate contract for Work outside of the scope of this Contract. Cooperate fully with separate contractors so Work on those contracts may be carried out smoothly, without interfering with or delaying Work under this Contract or other contracts. Coordinate the Work of this Contract with Work performed under separate contracts.
- C. Purchase Contracts: Town of Canton reserves the right to negotiate purchase contracts with suppliers of material and equipment that may be incorporated into the Work. Town of Canton may assign these purchase contracts to Contractor if such scope is added. Include costs for purchasing, receiving, handling, storage if required, and installation of material and equipment in the Contract Sum, unless otherwise indicated.
 1. Contractor's responsibilities are same as if Contractor had negotiated purchase contracts, including responsibility to renegotiate purchase and to execute final purchasing agreements.
- D. Owner-Furnished, Contractor-Installed Products (OFICI): Town of Canton will furnish products indicated. The Work includes receiving, unloading, handling, storing, protecting, and installing Town of Canton furnished products and making building services connections when applicable.
- E. Owner Furnished Products: Coordinate with Town of Canton.

1.7 ACCESS TO SITE

- A. General: Contractor shall have full use of Project site for construction operations during construction period. Contractor's use of Project site is limited only by Owner's right to perform work or to retain other contractors on portions of Project.
- B. Construction access path, contractor parking area(s), dumpster locations, temporary office location, and material storage/staging areas are to be provided as agreed to by the Town of Canton in advance of starting the work.
- C. Condition of Existing Building: Maintain portions of existing building affected by construction operations in weathertight condition throughout construction period. Repair damage caused by construction operations.

1.8 COORDINATION WITH OCCUPANTS

- A. Limited Town of Canton Occupancy of Completed Areas of Construction: Town of Canton reserves the right to occupy and to place and install equipment in completed portions of the Work, prior to Substantial Completion of the Work, provided occupancy does not interfere with completion of the Work. Such placement of equipment and limited occupancy shall not constitute acceptance of the total Work.
 1. Architect shall prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied prior to Town of Canton acceptance of the completed Work.
 2. Obtain a Certificate of Occupancy from authorities having jurisdiction before limited Town of Canton occupancy.
 3. Before limited Town of Canton occupancy, ensure mechanical and electrical systems are fully operational, and required tests and inspections and start up procedures are

successfully completed. On occupancy, Town of Canton shall operate and maintain mechanical and electrical systems serving occupied portions of Work.

4. Upon occupancy, Town of Canton shall assume responsibility for maintenance and custodial service for occupied portions of Work.

1.9 WORK RESTRICTIONS

- A. Work Restrictions: Comply with restrictions on construction operations. Comply with limitations on use of public streets and with other requirements of Authority Having Jurisdiction.
- B. On-Site Work Hours: Limit Work in the existing building to normal working hours, Monday through Friday, unless otherwise indicated. Coordinate with Town of Canton when it is necessary to extend working hours or Work on weekends.
- C. Work and storage areas are to be fenced with 6' high temporary chain link fencing unless otherwise noted on these plans or approved in writing, in advance of construction. Temporary fencing and barricades are to be maintained through substantial completion. The Contractor is responsible to ensure that the work area is secure, and to ensure the safety of students and staff.
- D. Work may not be performed, and materials may not be delivered to the job site during times when the Construction Superintendent is not on site. The Construction Superintendent is defined as a direct employee of the Contractor. This role may not be delegated to a subcontractor.
- E. Communications: All communication is to be routed to the Design Professional or the Town of Canton Representative. In the event of an emergency at the job site, the jobsite superintendent is to communicate the concern to the Town of Canton representative, and Design Professional.
- F. Any work that must be done outside of the designated construction area in order to accomplish the Work of the project must have prior written approval from the Owner's project representative and must be scheduled so as to avoid disrupting neighboring properties.
- G. Controlled Substances, Firearms, and Explosive Devices: Use of tobacco products, controlled substances, firearms, and explosive devices on the site is not permitted.

1.10 PROTECTION OF WORK AND ADJACENT PROPERTY

- A. Buildings and adjacent areas may be subject to damage due to construction operations. At the Completion of the project, the Contractor shall restore existing buildings, landscaping, turf, parking facilities, sidewalks, etc., to the same or better condition as prior to the start of the work.
- B. In addition to requirements of the General Conditions of the Contract for Construction, the Contractor shall:
 1. Notify, in writing, the Town of Canton when equipment or property interferes with the Work and arrange for disposition of such property.
 2. Provide coverings over inlets, area drains, drywells, etc. to prevent soil and construction debris from running into the storm system. In the event of a failure of a covering, the Contractor is required to clean the affected piping and structure(s) prior to substantial completion.
 3. Provide protection from rain, wind, and extreme temperatures to protect new work, materials, equipment, fixtures and adjacent areas from damage.
 4. Provide protection against stormwater back-ups when the storm system is affected by the work. Maintain flows as needed to avoid damage to the work and to surrounding areas.
 5. Provide temporary protection around openings through and at floors, roofs and other openings.
- C. The Contractor is required to photograph existing conditions related to existing conditions and to provide photographs in electronic format to the Design Professional and Facilities Operations Representative a minimum of 7 days prior to starting work on site. Sufficient photos with adequate detail to thoroughly document existing conditions shall be provided.

1.11 OWNER OCCUPANCY

- A. The Owner reserves the right to occupy and to install equipment in completed areas of the building prior to Substantial completion, provided that such occupancy does not interfere with completion of the work. Such occupancy shall not constitute acceptance of the work.
- B. Upon Substantial Completion of the project or portions thereof, the Owner will take occupancy. The Contractor is required to adjust work hours as needed in occupied areas so as to avoid disrupting Owners operations.
 - 1. Access to the facility and work area will be controlled by the Owner beginning at Substantial Completion. Refer also to the Close Out Procedures section.

1.12 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: Specifications use certain conventions for style of language and intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 - 1. Imperative mood and streamlined language are generally used in Specifications. The words "shall," "shall be," or "shall comply with," depending on context, are implied where a colon (:) is used within a sentence or phrase.
 - 2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of each Specification section.
- C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in Specifications. One or more of the following are used on Drawings to identify materials and products:
 - 1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
 - 2. Abbreviations: Materials and products are identified by abbreviations.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 CONSTRUCTION SCHEDULE

- A. Town of Canton has a critical need for the Work to begin upon Notice to Proceed and shall be Substantially Complete by Substantial Completion Date. There will be no Extensions of Time due to weather except in cases of extreme weather (hurricane, tornado, etc.). The impact of each extreme weather event on schedule shall be discussed by the Architect, Town of Canton, and Contractor.

END OF SECTION

SECTION 01 20 00 - PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Schedule of values.
- B. Applications for progress payments.
- C. Application at time of substantial completion.
- D. Final payment application.
- E. Payment for stored materials.
- F. Substantiating data.
- G. Application for final payment.
- H. Defect Assessment.

1.2 SCHEDULE OF VALUES

- A. Use Schedule of Values Form: AIA G703, edition stipulated in the Agreement.
- B. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:
 - 1. Application for Payment forms with continuation sheets.
 - 2. Submittal schedule.
 - 3. Items required to be indicated as separate activities in Construction Manager's construction schedule.
- C. Submit Schedule of Values in duplicate within 10 days after date of Owner-Contractor Agreement.
- D. Subschedules of Values
 - 1. Subschedules: Provide subschedules in a form of submittal shall parallel that of the Schedule of Values, with each item identified the same as the line item in the Schedule of Values.
 - a. The unit values for the materials shall be broken down into:
 - 1) Cost of the material delivered and unloaded at the site, with taxes paid.
 - 2) Installation costs, including Construction Manager's overhead and profit.
 - 3) Material and labor cost per division for FEMA reports to improve the resilience of the building shall be broken down. Coordinate with Architect items required to be included.
 - 2. 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 measured quantity. Use information indicated in the Contract Documents to determine quantities.
 - 3. Unit Costs: Submit a Sub-schedule of unit cost and quantities for products on which progress payments will be requested for stored products.
 - a. The unit quantity for bulk materials shall include an allowance for normal waste. The installed unit value, multiplied by the quantity listed, shall equal the cost of that item in the Schedule of Values.
- E. Format and Content:
 - 1. Use 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 and one line for each product listed in the Summary section where applicable.
 - a. Identification: Include the following Project identification on the schedule of values:
 - 1) Project name and location.
 - 2) Name of Architect.
 - 3) Architect's project number.

- 4) Construction Manager's name and address.
 - 5) Date of submittal.
 - b. Arrange schedule of values consistent with format of AIA Document G703 or Construction Manager's form as approved by the Architect.
 - c. Arrange the schedule of values in tabular form with separate columns to indicate the following for each item listed:
 - 1) Related Specification Section or Division.
 - 2) Description of the Work.
 - 3) Change Orders (numbers) that affect value.
 - 4) Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
 - (a) Labor.
 - (b) Materials.
 - (c) Equipment.
 - d. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual table of contents. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
 - 1) Include separate line items under Construction Manager and principal subcontracts for Project closeout requirements in an amount totaling five percent of the Contract Sum and subcontract amount.
 - e. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
- F. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.
- G. Include in each line item, the amount of Allowances specified in this section. For unit cost Allowances, identify quantities taken from Contract Documents multiplied by the unit cost to achieve the total for the item.
- H. Revise schedule to list approved Change Orders, with each Application For Payment.

1.3 APPLICATIONS FOR PROGRESS PAYMENTS

- A. Use Form AIA G702 and Form AIA G703, edition stipulated in the Agreement.
- B. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to Architect for approval.
- C. Forms filled out by hand will not be accepted.
- D. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
 1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.
- E. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. 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 for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
 3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

- F. When Architect finds Application properly completed and correct, he will transmit Certificate for Payment to Owner. Incorrect or incomplete Certificates will not be reviewed until they have been corrected and resubmitted by the Contractor.
- G. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored on site, but not yet installed. Differentiate between items stored on-site and items stored off-site.
 - 1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
 - 2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
 - 3. Provide summary documentation for stored materials indicating the following:
 - a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
 - b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
 - c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.
- H. Transmittal: Submit one (1) signed and notarized original copies electronically of each Application for Payment to Architect by a method ensuring receipt within 24 hours. It shall include waivers of lien and similar attachments if required.
 - 1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
- I. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's liens from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.
 - 1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
 - 2. When an application shows completion of an item, submit conditional final or full waivers.
 - 3. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
 - 4. Waiver Forms: Submit executed waivers of lien on forms, acceptable to Owner.
- J. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
 - 1. List of subcontractors.
 - 2. Schedule of values.
 - 3. Contractor's construction schedule (preliminary if not final).
 - 4. Products list (preliminary if not final).
 - 5. Submittal schedule (preliminary if not final).
 - 6. List of Contractor's staff assignments.
 - 7. List of Contractor's principal consultants.
 - 8. Copies of building permits.
 - 9. Report of preconstruction conference.
 - 10. Certificates of insurance and insurance policies
 - 11. Performance and payment bonds.
 - 12. Data needed to acquire Owner's insurance.
- K. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.

1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
3. Administrative actions and submittals that shall proceed or coincide with this application include:
 - a. Occupancy permits and similar approvals.
 - b. Warranties (guarantees) and maintenance agreements.
 - c. Test/adjust/balance records.
 - d. Maintenance instructions.
 - e. Meter readings.
 - f. Start-up performance reports.
 - g. Change-over information, including door lock change over, related to Owner's occupancy, use, operation and maintenance.
 - h. Final cleaning.
 - i. Application for reduction of retainage and consent of surety.
 - j. Advice on shifting insurance coverage.
 - k. Final progress photographs.
 - l. List of incomplete work, recognized as exceptions to Architect's Certificate of Substantial Completion.
4. After the Certificate of Substantial Completion has been executed by all parties concerned and before payment is made the Contractor shall submit the following documents:
 - a. Submit CONSENT OF SURETY TO FINAL REDUCTION IN OR PARTIAL RELEASE OF RETAINAGE, A.I.A. Document G707A, if not previously submitted.
- L. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, 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. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
 4. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
 5. AIA Document G707, "Consent of Surety to Final Payment."
 6. Evidence that claims have been settled.
 7. Final meter readings for utilities and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
 8. Final liquidated damages settlement statement.
 9. Four (4) signed and notarized original copies and noted as Final Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.
 10. Final schedule of values.
 11. Power of attorney from Surety for release of final payment, signed and sealed and dated same as Consent of Surety.
 12. Certificate of Contract Completion:
 13. Page one completed by the Construction Manager, submit original plus three copies.
 14. Page two completed by the Architect, submit original plus three copies.
 15. Construction Manager's certification letter for the Guarantee of Construction for one year from substantial completion.

16. Copy of the approval and verification of transmittal by the Construction Manager to the Architect of manuals, shop drawings, as built (one set of sepia and two sets prints), brochures, warranties and list of subcontractors with telephone numbers and addresses.
 17. Verification that the owner's personnel have been trained in the operation of their new equipment (HVAC, controls, fire alarm, etc.) with list of attendees at each training session.
 18. Fully executed warranties in the name of the owner. Architect's Certificate of Specification of Asbestos Containing Materials.
 19. Construction Manager's Certificate of Asbestos Use.
 20. Copy of Certificate of Occupancy.
- M. When Architect requires substantiating information, submit data justifying dollar amounts in question. Provide one copy of data with cover letter for each copy of submittal. Show application number and date, and line item by number and description.

1.4 APPLICATION AT TIME OF SUBSTANTIAL COMPLETION

- A. See Supplemental and General Conditions for principal administrative actions and submittals which must precede or coincide with such special applications.

1.5 FINAL PAYMENT APPLICATION

- A. See General Conditions, Supplemental Conditions and Closeout Submittals and Procedures for principal administrative actions and submittals which must precede or coincide with such special applications.

1.6 PAYMENT FOR STORED MATERIAL

- A. Payment for stored items will be subject to prior approval by the Owner.
1. On-Site Materials: Progress payments may be made for permanent materials and equipment to be incorporated in the work if approved in advance and properly stored on the project site.
 2. Off-Site Materials: Progress payments may be made for permanent, pre-fabricated materials or specially designed equipment to be incorporated into the work if approved in advance per terms of General Conditions and stored in accordance with manufacturer's instructions.
- B. Proof of Need: With payment request for stored material, submit a copy of purchase order and payment voucher clearly identifying the material, specification reference, contract number and price. The following additional documentation may be included.
1. Notarized certification of payment from supplier.
 2. Copy of canceled check to supplier.
 3. Lien release from supplier.
 4. Copy of insurance as required by General Conditions.
- C. Verification of Price and Payment: The Contractor shall demonstrate that the costs of materials have been paid and will establish the Owner's title to such materials or equipment or otherwise protect the Owner's interest including applicable insurance and transportation for those items stored off-site.
- D. Partial payment for materials and equipment in advance of installation shall not constitute acceptance thereof and will not relieve Contractor of full responsibility for condition and subsequent acceptance by the Owner. Faulty materials discovered will be rejected even though partial payment may have been made.

1.7 SUBSTANTIATING DATA

- A. When Architect / Engineer requires substantiating information, submit data within three working days, justifying line item amounts in question.

1.8 MODIFICATION PROCEDURES

- A. Refer to section 012600 - Contract Modification Procedures.
- B. For minor changes not involving an adjustment to the Contract Sum or Contract Time, Architect will issue instructions directly to Contractor on a Supplemental Instruction form - "SI".

- C. For other required changes, Architect will issue a document signed by Town of Canton instructing to proceed with the change, for subsequent inclusion in a Change Order for signatures of parties as provided in the Conditions of the Contract.
 - 1. The document will describe the required changes and will designate method of determining any change in Contract Sum or Contract Time.
 - 2. Promptly execute the change in Work.
- D. For changes for which advance pricing is desired, Architect will issue a document that includes a detailed description of a proposed change with supplementary or revised drawings and specifications, a change in Contract Time for executing the change with a stipulation of any overtime work required and the period of time during which the requested price will be considered valid. Contractor shall prepare and submit a fixed price quotation within a timely manner. A change order proposal will be issued by the Architect for signatures of parties as provided in the Conditions of the Contract on State Change Order Proposal Form - "COP".
- E. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.
 - 1. For change requested by Architect for work falling under a fixed price contract, the amount will be based on Contractor's price quotation.
 - 2. For change requested by Contractor, the amount will be based on the Contractor's request for a Change Order as approved by Architect.
 - 3. For change ordered by Architect without a quotation from Contractor, the amount will be determined by Architect based on the Contractor's substantiation of costs as specified for Time and Material work.
- F. After execution of Change Order, promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum.

1.9 APPLICATION FOR FINAL PAYMENT

- A. See Supplemental and General Conditions for principal administrative actions and submittals which must precede or coincide with such special applications.

1.10 DEFECT ASSESSMENT

- A. Replace the Work, or portions of the Work, not conforming to specified requirements.
- B. If, in the opinion of the Architect, it is not practical to remove and/or replace the Work at the time of application for payment, the Architect will direct one of the following remedies:
 - 1. The defective Work may remain, but the unit sum/price will be reduced (50%) or an amount at the discretion of the Architect.
 - 2. The defective Work will be partially repaired to the instructions of the Architect, and the unit sum/price will be adjusted to a new sum/price at the discretion of the Architect.
- C. The authority of the Architect to assess the defect and identify payment adjustment, is final.
- D. Reduction of the amount requested in the "application for payment" does not constitute Owner's acceptance of the Work or release the Contractor from his obligation to complete and/or correct the work before the next application for payment unless specifically agreed by the Architect and processed via a Change Order.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 01 21 00 - ALLOWANCES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

- A. Administrative and procedural requirements governing allowances.
 - 1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when directions will be provided to Contractor. If necessary, additional requirements will be issued by Change Order.
- B. Types of allowances include the following:
 - 1. Lump-sum allowances.
 - 2. Adjustment of allowances.

1.3 LUMP SUM ALLOWANCES

- A. Line items for each lump sum allowance scheduled shall be included on the "Schedule of Values" included with the Application for Lump Sum Payment.
- B. Contractor's costs associated with the allowances shall be based on the invoice amount from the subcontractor/utility company plus 7 ½ percent for Contractor's handling. Contractor shall coordinate work with subcontractor/utility company, obtain written cost estimate from the subcontractor/utility company, and have estimate approved by Owner prior to beginning work.
- C. Should the lump sum allowances be exceeded, change orders authorizing additional costs shall be executed using the same basis of the original allowance (subcontractor/utility company invoice plus 7 ½ percent for Contractor's handling).
- D. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Architect under allowance and shall include taxes, freight, and delivery to Project site.
- E. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials selected by Architect under allowance shall be included as part of the Contract Sum and not part of the allowance.
- F. Unused Materials: Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.
 - 1. If requested by Architect, retain and prepare unused material for storage by Owner. Deliver unused material to Owner's storage space as directed.
- G. At project closeout, credit all unused allowances remaining in the Schedule of Values to Owner by Change Order.

1.4 ADJUSTMENT OF ALLOWANCES

- A. Allowance Adjustment: To adjust allowance amounts, prepare a Change Order proposal based on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place where applicable. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.
 - 1. Include installation costs in purchase amount only where indicated as part of the allowance.
 - 2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other margins claimed.

3. Submit substantiation of a change in scope of work, if any, claimed in Change Orders related to unit-cost allowances.
 4. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.
- B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the purchase order amount or Contractor's handling, labor, installation, overhead, and profit.
1. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of work has changed from what could have been foreseen from information in the Contract Documents.
 2. No change to Contractor's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Products and or materials used in allowances shall be as defined or approved elsewhere in the Contract Documents.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

- A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.3 SCHEDULE OF ALLOWANCES

- A. Allowance No. 1 - Replace Wood Decking (See Section 01 22 00, 1.8, A):
1. Include in bid an allowance of \$300,000 to replace unsuitable wood roof decking.
- B. Allowance No. 2 - Repair and Repoint Masonry (See Section 01 22 00, 1.8, B):
1. Include in bid an allowance of \$100,000 to repair and repaint masonry.
- C. Allowance No. 3 - New Signage (See Section 10 14 19):
1. Include in bid an allowance of \$5,000 for new signage.
- D. Allowance No. 4 - General Allowance:
1. Include an allowance in the amount of \$250,000 for miscellaneous and general contingency items not addressed in the bid documents.

END OF SECTION

SECTION 01 22 00 - UNIT PRICES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

- A. List of unit prices, for use in preparing Bids.
- B. Measurement and payment criteria applicable to Work performed under a unit price payment method.
- C. Payment.
- D. Defect assessment and non-payment for rejected work.

1.3 COSTS INCLUDED

- A. Unit Prices included on the Bid Form shall include full compensation for all required labor, products, tools, equipment, plant, transportation, services and incidentals; erection, application or installation of an item of the Work; overhead and profit.

1.4 UNIT QUANTITIES SPECIFIED

- A. Quantities indicated in the Bid Form are for bidding and contract purposes only. Quantities and measurements of actual Work will determine the payment amount.

1.5 MEASUREMENT OF QUANTITIES

- A. Measurement methods delineated in the individual specification sections complement the criteria of this section. In the event of conflict, the requirements of the individual specification section govern.
- B. Assist by providing necessary equipment, workers, and survey personnel as required.
- C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this Work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.

1.6 PAYMENT

- A. Payment for Work governed by unit prices will be made on the basis of the actual measurements and quantities of Work that is incorporated in or made necessary by the Work and accepted by the Architect, multiplied by the unit price.
- B. Payment will not be made for any of the following:
 - 1. Products wasted or disposed of in a manner that is not acceptable.
 - 2. Products determined as unacceptable before or after placement.
 - 3. Products not completely unloaded from the transporting vehicle.
 - 4. Products placed beyond the lines and levels of the required Work.
 - 5. Products remaining on hand after completion of the Work.
 - 6. Loading, hauling, and disposing of rejected Products.

1.7 DEFECT ASSESSMENT

- A. Replace Work, or portions of the Work, not complying with specified requirements.
- B. If, in the opinion of Town of Canton, it is not practical to remove and replace the Work, Town of Canton will direct one of the following remedies:
- C. The individual specification sections may modify these options or may identify a specific formula or percentage price reduction.

- D. The authority of Town of Canton to assess the defect and identify payment adjustment is final.

1.8 SCHEDULE OF UNIT PRICES

- A. Unit Price No. 1: Replace Wood Decking
1. Description: This Unit Price shall be the entire unit cost including overhead and profit to replace unsuitable wood roof decking. Cost shall include all materials and labor for complete installation. Enter unit cost on Proposal Form.
 2. Unit of Measure: U.S. Dollars (\$) per Square Foot (SF).
- B. Unit Price No. 2: Masonry Repair
1. Description: This Unit Price shall be the entire unit cost including overhead and profit to repair masonry (see section 04 10 24). Cost shall include all materials and labor for complete installation. Enter unit cost on Proposal Form.
 2. Unit of Measure: U.S. Dollars (\$) per Square Foot (SF).

PART 2 PRODUCTS - NOT APPLICABLE

PART 3 EXECUTION - NOT APPLICABLE

END OF SECTION

SECTION 01 23 00 - ALTERNATES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

- A. Acceptance of Alternates.
- B. Schedule of Alternates.

1.3 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. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
 - 2. 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.

1.4 ACCEPTANCE OF ALTERNATES

- A. Revise 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 revisions 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.

1.5 SCHEDULE OF ALTERNATES

- A. Alternate No. 1: Kitchen equipment, and installation of kitchen equipment:
 - 1. Base Bid: General Contractor to purchase and install kitchen equipment including providing all equipment connections.
 - 2. Alternate: Owner to purchase all kitchen equipment, and turn over to General Contractor. (General Contractor to install equipment and provide all equipment connections as a part of the base contract.)
- B. Alternate No. 2: Removalbe Flood Barrier System (See Section 10 71 19.16)
 - 1. Base Bid: Removable flood barreir system and required support connections not part of base bid
 - 2. Alternate: Contractor to provide and install flood barrier system and required support connections at all windows and doors on main level from sill to 6'-0" above finished floor.

PBK Architects
PBK Project No. 23029.00
Construction Documents

Town of Canton
Armory Community Center Renovation
November 12, 2025

PART 2 PRODUCTS - NOT USED
PART 3 EXECUTION - NOT USED
END OF SECTION

SECTION 01 26 00 - CONTRACT MODIFICATION PROCEDURES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

- A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

1.3 REFERENCE STANDARDS

- A. AIA G709 - Proposal Request; 2018.

1.4 REFERENCES

- A. Refer to specification Section 014100 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 MINOR CHANGES IN WORK

- A. Architect will issue Architectural Supplemental Instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710, "Architect's Supplemental Instructions".

1.6 ARCHITECTURAL SUPPLEMENTAL CHANGES

- A. Architect will issue Architectural Supplemental Instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710, "Architect's Supplemental Instructions."
- B. In the event a change in Contract Sum or Contract Time is required by the Construction Manager, he shall so inform the Architect in writing within one (1) week of receipt of Supplemental Instruction or Clarification. A subsequent Proposal Request and Change Order will be issued prior to the Construction Manager proceeding with the work unless a specific cost and/or time change has been agreed to and authorization to proceed is included in the Supplemental Instruction or is subsequently issued.
- C. Architect will sign and date the Supplemental Instruction or Clarification as authorization for the Contractor to proceed with changes.
- D. Construction Manager will sign and date the Supplemental Instruction to indicate agreement with the terms therein and return to the Architect.

1.7 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Architect 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. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
 - 2. Within twenty (20) days, when not otherwise specified, after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
 - 3. Include 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.
 - 4. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - 5. Include costs of labor and supervision directly attributable to the change.

6. Include 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.
 7. Proposal Requests are not valid until Architect and Owner approve in writing. Upon approval the Proposal Request will be incorporated into a Contingency Adjustment Authorization.
 8. Quotation Form:
- B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim 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.
 2. Include 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.
 3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 4. Include costs of labor and supervision directly attributable to the change.
 5. Include 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.
 6. Comply with requirements in specification section "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
 7. Proposal Requests are not valid until Architect and Owner approve in writing. Upon approval the Proposal Request will be incorporated into a Contingency Adjustment Authorization.
 8. Proposal Request Form:

1.8 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714 – "Construction Change Directive" instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

1.9 CHANGE ORDER PROCEDURES

- A. On Owner's approval of a Work Changes Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on AIA Document G701 – "Change Order".
- B. Change Order will constitute authorization to proceed with additions and deletions as defined by Proposal Request.
- C. Change Order will provide an accounting of the adjustment in the Contract Sum and/or Contract Time.
- D. Content of Change Order will be based on either:
1. Architect's Proposal Request and Contractor's responsive Proposal as mutually agreed between Owner and Contractor.
 2. Contractor's Proposal for a change as recommended by Architect.
 3. Owner authorized Construction Change Directive as mutually agreed between Owner and Contractor and recommended by Architect.
 4. Executed Architect's Supplemental Instructions.

- E. Owner will sign and date the Change Order as authorization for the Contractor to proceed with the changes.
- F. Contractor will sign and date the Change Order to indicate agreement with the terms therein.

1.10 CORRELATION WITH CONTRACTOR'S SUBMITTAL

- A. Periodically revise Schedule of Values and Request for Payment forms to record each change as a separate item of work, and to record the adjusted Contract Sum. Submit along with Applications for Payment.
- B. Periodically revise the Construction Schedule to reflect each change in Contract Time:
 - 1. Revise schedules to show changes for other items of work affected by the changes.
 - 2. Submit revised Schedule to Architect and Owner; submit revised schedules to sub-contractors of other work affected by the changes.

1.11 EXECUTION OF CONSTRUCTION CHANGE DIRECTIVES AND PROPOSAL REQUESTS

- A. Construction Manager shall, upon receipt of either document, proceed in a timely fashion to execute the documents and incorporate required items into the project when so indicated. Execute documents within two (2) weeks.
- B. Construction Manager shall inform all affected trades immediately upon receipt of above mentioned documents and receive written indication of either no change in Contract Price, or a fully itemized breakdown of costs to be incurred. Price breakdowns shall be documented as indicated.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 EXECUTION OF CONSTRUCTION CHANGE DIRECTIVES AND PROPOSAL REQUESTS

- A. Construction Manager shall, upon receipt of either document, proceed in a timely fashion to execute the documents and incorporate required items into the project when so indicated. Execute documents within two (2) weeks.
- B. Construction Manager shall inform all affected trades immediately upon receipt of above mentioned documents and receive written indication of either no change in Contract Price, or a fully itemized breakdown of costs to be incurred. Price breakdowns shall be documented as indicated.

END OF SECTION

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SECTION 01 30 00 - ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

- A. General coordination procedures.
- B. General administrative requirements.
- C. Information submittals.
- D. Project site use plan.
- E. Electronic document submittal service.
- F. Preconstruction meeting.
- G. Progress meetings.
- H. Preinstallation conferences.
- I. Construction progress schedule.
- J. Contractor's daily reports.
- K. Progress photographs.
- L. Requests for Interpretation (RFI) procedures.
- M. Submittal schedule.
- N. Submittals for review, information, and project closeout.
- O. Number of copies of submittals.
- P. Submittal procedures.
- Q. Submittal review.

1.3 REFERENCE STANDARDS

- A. AIA G716 - Request for Information; 2004.
- B. AIA G810 - Transmittal Letter; 2001.
- C. CSI/CSC Form 12.1A - Submittal Transmittal; Current Edition.
- D. CSI/CSC Form 13.2A - Request for Information; Current Edition.

1.4 REFERENCES

- A. Refer to specification Section 014100 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 GENERAL COORDINATION PROCEDURES

- 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 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 ensure maximum performance and accessibility for required maintenance, service, and repair.

3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities 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 Construction Manager'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. Preinstallation conferences.
 7. Project closeout activities.
 8. Startup and adjustment of systems.
- D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.
 1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

1.6 GENERAL ADMINISTRATIVE REQUIREMENTS

- A. Comply with requirements of Section 01 70 00 - Execution and Closeout Requirements for coordination of execution of administrative tasks with timing of construction activities.
- B. Make the following types of submittals to Architect:
 1. Requests for Interpretation (RFI).
 2. Requests for substitution.
 3. Shop drawings, product data, and samples.
 4. Test and inspection reports.
 5. Design data.
 6. Manufacturer's instructions and field reports.
 7. Applications for payment and change order requests.
 8. Progress schedules.
 9. Coordination drawings.
 10. Correction Punch List and Final Correction Punch List for Substantial Completion.
 11. Closeout submittals.

1.7 INFORMATIONAL SUBMITTALS

- A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
 1. Name, address, and telephone number of entity performing subcontract or supplying products.
 2. Number and title of related Specification Section(s) covered by subcontract.
 3. Drawing number and detail references, as appropriate, covered by subcontract.
- B. Key Personnel Names: Within fifteen (15) days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.

1. Post copies of list in temporary field office. Keep list current at all times.

1.8 PROJECT USE SITE PLAN

- A. The Construction Manager shall prepare a proposed project use of the site plan.
- B. Construction Manager shall confine operations at the site to areas within the areas indicated and as approved on the use of the site plan, and as permitted by law, ordinances, and permits. Site shall not be unreasonably encumbered with materials, products, or construction equipment.
- C. The Construction Manager in reviewing his use of the site shall include access to proposed building for construction purposed, storage of materials and products, parking, where possible, for employees, temporary facilities including offices, storage, and workshop sheds or portable trailers, and unloading space.
- D. Where a temporary fence is to be provided, the Construction Manager shall show any additional area needed in the Construction Manager's use of the site beyond that which may be indicated on the Drawings. Where additional fencing is required, such fencing shall be included at no additional cost to the Owner.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 ELECTRONIC DOCUMENT SUBMITTAL SERVICE

- A. All documents transmitted for purposes of administration of the contract are to be in electronic (PDF, MS Word, or MS Excel) format, as appropriate to the document, and transmitted via an Internet-based submittal service that receives, logs and stores documents, provides electronic stamping and signatures, and notifies addressees via email.
 1. Besides submittals for review, information, and closeout, this procedure applies to Requests for Interpretation (RFIs), progress documentation, contract modification documents (e.g. supplementary instructions, change proposals, change orders), applications for payment, field reports and meeting minutes, Contractor's correction punchlist, and any other document any participant wishes to make part of the project record.
 2. Contractor and Architect are required to use this service.
 3. It is Contractor's responsibility to submit documents in allowable format.
 4. Subcontractors, suppliers, and Architect's consultants will be permitted to use the service at no extra charge.
 5. Users of the service need an email address, internet access, and PDF review software that includes ability to mark up and apply electronic stamps (such as Adobe Acrobat, www.adobe.com, or Bluebeam PDF Revu, www.bluebeam.com), unless such software capability is provided by the service provider.
 6. Paper document transmittals will not be reviewed; emailed electronic documents will not be reviewed.
 7. All other specified submittal and document transmission procedures apply, except that electronic document requirements do not apply to samples or color selection charts.
- B. Submittal Service: The selected service is:
- C. Training: One, one-hour, web-based training session will be arranged for all participants, with representatives of Architect and Contractor participating; further training is the responsibility of the user of the service.
- D. Project Closeout: Architect will determine when to terminate the service for the project and is responsible for obtaining archive copies of files for Town of Canton.

3.2 PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
 3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three (3) days of the meeting.
- B. Preconstruction Conference:
1. Schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 10 days after Notice to proceed.
 2. Conduct the conference to review responsibilities and personnel assignments.
 3. Attendance Required:
 - a. Town of Canton
 - b. Architect.
 - c. Contractor.
 4. Agenda:
 - a. Execution of Town of Canton-Contractor Agreement.
 - b. Submission of executed bonds and insurance certificates.
 - c. Distribution of Contract Documents.
 - d. Submission of list of subcontractors, list of products, schedule of values, and progress schedule.
 - e. Designation of personnel representing the parties to Contract and Architect.
 - f. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
 - g. Scheduling.
 5. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Town of Canton, participants, and those affected by decisions made.
- C. Progress Meetings:
1. Schedule and administer meetings throughout progress of the work at Project Site unless otherwise indicated.
 - a. Attendance Required:
 - 1) Contractor.
 - 2) Town of Canton.
 - 3) Architect.
 - 4) Contractor's superintendent.
 - 5) Major subcontractors.
 - b. Agenda:
 - 1) Review minutes of previous meetings.
 - 2) Review of work progress.
 - 3) Field observations, problems, and decisions.
 - 4) Identification of problems that impede, or will impede, planned progress.
 - 5) Review of submittals schedule and status of submittals.
 - 6) Maintenance of progress schedule.
 - 7) Corrective measures to regain projected schedules.
 - 8) Planned progress during succeeding work period.
 - 9) Maintenance of quality and work standards.
 - 10) Effect of proposed changes on progress schedule and coordination.
 - 11) Other business relating to work.
 - c. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Town of Canton, participants, and those affected by decisions made.

- D. Progress Meetings: Conduct progress meetings at weekly, biweekly, monthly intervals.
1. Coordinate dates of meetings with preparation of payment requests.
 2. Attendees: In addition to representatives of Commissioning Authority, Construction Manager and Architect, 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 meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 3. Agenda: Review and correct or approve 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. Construction Manager'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 Construction Manager'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) Status of sustainable design documentation.
 - 5) Deliveries.
 - 6) Off-site fabrication.
 - 7) Access.
 - 8) Site utilization.
 - 9) Temporary facilities and controls.
 - 10) Progress cleaning.
 - 11) Quality and work standards.
 - 12) Status of correction of deficient items.
 - 13) Field observations.
 - 14) Status of RFIs.
 - 15) Status of proposal requests.
 - 16) Pending changes.
 - 17) Status of Change Orders.
 - 18) Pending claims and disputes.
 - 19) Documentation of information for payment requests.
 - 20) Tracking logs.
 - c. Schedule Updating: Revise Construction Manager'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.

3.3 CONSTRUCTION PROGRESS SCHEDULE

- A. Within 10 days after date of the Agreement, submit preliminary schedule defining planned operations for the first 60 days of work, with a general outline for remainder of work.
- B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.
- C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
 1. Include written certification that major contractors have reviewed and accepted proposed schedule.
- D. Within 10 days after joint review, submit complete schedule.

- E. Submit updated schedule with each Application for Payment.

3.4 DAILY CONSTRUCTION REPORTS

- A. Include only factual information. Do not include personal remarks or opinions regarding operations and/or personnel.
- B. Prepare a daily construction report recording the following information concerning events at Project site and project progress:
 - 1. Date.
 - 2. High and low temperatures, and general weather conditions.
 - 3. List of subcontractors at Project site.
 - 4. List of separate contractors at Project site.
 - 5. Approximate count of personnel at Project site.
 - a. Include a breakdown for supervisors, laborers, journeymen, equipment operators, and helpers.
 - 6. Major equipment at Project site.
 - 7. Material deliveries.
 - 8. Safety, environmental, or industrial relations incidents.
 - 9. Meetings and significant decisions.
 - 10. Unusual events (submit a separate special report).
 - 11. Stoppages, delays, shortages, and losses. Include comparison between scheduled work activities (in Contractor's most recently updated and published schedule) and actual activities. Explain differences, if any. Note days or periods when no work was in progress and explain the reasons why.
 - 12. Directives and requests of Authority(s) Having Jurisdiction (AHJ).
 - 13. Testing and/or inspections performed.
 - 14. List of verbal instruction given by Town of Canton and/or Architect.
 - 15. Signature of Contractor's authorized representative.

3.5 PROGRESS PHOTOGRAPHS

- A. Submit photographs with each application for payment, taken not more than 3 days prior to submission of application for payment.
- B. Submit new photographs at least once a month, within 3 days after being taken.
- C. Maintain one set of all photographs at project site for reference; same copies as submitted, identified as such.
- D. Photography Type: Digital; electronic files.
- E. Provide photographs of site and construction throughout progress of work produced by an experienced photographer, acceptable to Architect.
- F. Views:
 - 1. Provide non-aerial photographs from four cardinal views at each specified time, until date of Substantial Completion.
 - 2. Consult with Architect for instructions on views required.
 - 3. Provide factual presentation.
 - 4. Provide correct exposure and focus, high resolution and sharpness, maximum depth of field, and minimum distortion.
 - 5. Digital Photographs: 24 bit color, minimum resolution of 1024 by 768, in JPG format; provide files unaltered by photo editing software.
 - a. File Naming: Include project identification, date and time of view, and view identification.

3.6 REQUESTS FOR INTERPRETATION (RFI)

- A. Definition: A request seeking one of the following:

1. An interpretation, amplification, or clarification of some requirement of Contract Documents arising from inability to determine from them the exact material, process, or system to be installed; or when the elements of construction are required to occupy the same space (interference); or when an item of work is described differently at more than one place in Contract Documents.
2. A resolution to an issue which has arisen due to field conditions and affects design intent.
- B. Whenever possible, request clarifications at the next appropriate project progress meeting, with response entered into meeting minutes, rendering unnecessary the issuance of a formal RFI.
- C. Preparation: Prepare an RFI immediately upon discovery of a need for interpretation of Contract Documents. Failure to submit a RFI in a timely manner is not a legitimate cause for claiming additional costs or delays in execution of the work.
 1. Prepare a separate RFI for each specific item.
 2. Prepare in a format and with content acceptable to Town of Canton.
- D. Reason for the RFI: Prior to initiation of an RFI, carefully study all Contract Documents to confirm that information sufficient for their interpretation is definitely not included.
 1. Include in each request Contractor's signature attesting to good faith effort to determine from Contract Documents information requiring interpretation.
 2. Unacceptable Uses for RFIs: Do not use RFIs to request the following:
 - a. Approval of submittals (use procedures specified elsewhere in this section).
 - b. Approval of substitutions (see Section - 01 60 00 - Product Requirements)
 - c. Changes that entail change in Contract Time and Contract Sum (comply with provisions of the Conditions of the Contract).
 - d. Different methods of performing work than those indicated in the Contract Drawings and Specifications (comply with provisions of the Conditions of the Contract).
 3. Improper RFIs: Requests not prepared in compliance with requirements of this section, and/or missing key information required to render an actionable response. They will be returned without a response, with an explanatory notation.
 4. Frivolous RFIs: Requests regarding information that is clearly indicated on, or reasonably inferable from, Contract Documents, with no additional input required to clarify the question. They will be returned without a response, with an explanatory notation.
 - a. The Town of Canton reserves the right to assess the Contractor for the costs (on time-and-materials basis) incurred by the Architect, and any of its consultants, due to processing of such RFIs.
- E. Content: Include identifiers necessary for tracking the status of each RFI, and information necessary to provide an actionable response.
 1. Official Project name and number, and any additional required identifiers established in Contract Documents.
 2. Town of Canton's, Architect's, and Contractor's names.
 3. Discrete and consecutive RFI number, and descriptive subject/title.
 4. Issue date, and requested reply date.
 5. Reference to particular Contract Document(s) requiring additional information/interpretation. Identify pertinent drawing and detail number and/or specification section number, title, and paragraph(s).
 6. Annotations: Field dimensions and/or description of conditions which have engendered the request.
 7. Contractor's suggested resolution: A written and/or a graphic solution, to scale, is required in cases where clarification of coordination issues is involved, for example; routing, clearances, and/or specific locations of work shown diagrammatically in Contract Documents. If applicable, state the likely impact of the suggested resolution on Contract Time or the Contract Sum.

- F. Attachments: Include sketches, coordination drawings, descriptions, photos, submittals, and other information necessary to substantiate the reason for the request.
- G. RFI Log: Prepare and maintain a tabular log of RFIs for the duration of the project.
 - 1. Indicate current status of every RFI. Update log promptly and on a regular basis.
- H. Review Time: Architect will respond and return RFIs to Contractor within seven calendar days of receipt. For the purpose of establishing the start of the mandated response period, RFIs received after 12:00 noon will be considered as having been received on the following regular working day.
 - 1. Response period may be shortened or lengthened for specific items, subject to mutual agreement, and recorded in a timely manner in progress meeting minutes.
- I. Responses: Content of answered RFIs will not constitute in any manner a directive or authorization to perform extra work or delay the project. If in Contractor's belief it is likely to lead to a change to Contract Sum or Contract Time, promptly issue a notice to this effect, and follow up with an appropriate Change Order request to Town of Canton.
 - 1. Response may include a request for additional information, in which case the original RFI will be deemed as having been answered, and an amended one is to be issued forthwith. Identify the amended RFI with an R suffix to the original number.
 - 2. Do not extend applicability of a response to specific item to encompass other similar conditions, unless specifically so noted in the response.
 - 3. Upon receipt of a response, promptly review and distribute it to all affected parties, and update the RFI Log.
 - 4. Notify Architect within seven calendar days if an additional or corrected response is required by submitting an amended version of the original RFI, identified as specified above.

3.7 SUBMITTAL SCHEDULE

- A. Submit to Architect for review a schedule for submittals in tabular format.
 - 1. Coordinate with Contractor's construction schedule and schedule of values.
 - 2. Format schedule to allow tracking of status of submittals throughout duration of construction.
 - 3. Arrange information to include scheduled date for initial submittal, specification number and title, submittal category (for review or for information), description of item of work covered, and role and name of subcontractor.
 - 4. Account for time required for preparation, review, manufacturing, fabrication and delivery when establishing submittal delivery and review deadline dates.
 - a. For assemblies, equipment, systems comprised of multiple components and/or requiring detailed coordination with other work, allow for additional time to make corrections or revisions to initial submittals, and time for their review.
 - 5. Initial Submittal: Submit concurrently with preliminary bar-chart schedule. Include submittals required during the first 60 days of construction. List those required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
 - 6. Final Submittal: Submit concurrently with the first complete submittal of Contractor's Construction Schedule.

3.8 SUBMITTALS FOR REVIEW

- A. When the following are specified in individual sections, submit them for review:
 - 1. Product data.
 - 2. Shop drawings.
 - 3. Samples for selection.
 - 4. Samples for verification.
- B. Submit to Architect for review for the limited purpose of checking for compliance with information given and the design concept expressed in Contract Documents.
- C. Samples will be reviewed for aesthetic, color, or finish selection.

- D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01 78 00 - Closeout Submittals.

3.9 SUBMITTALS FOR INFORMATION

- A. When the following are specified in individual sections, submit them for information:
1. Design data.
 2. Certificates.
 3. Test reports.
 4. Inspection reports.
 5. Manufacturer's instructions.
 6. Manufacturer's field reports.
 7. Other types indicated.
- B. Submit for Architect's knowledge as contract administrator or for Town of Canton.

3.10 SUBMITTALS FOR PROJECT CLOSEOUT

- A. Submit Correction Punch List for Substantial Completion.
- B. Submit Final Correction Punch List for Substantial Completion.
- C. When the following are specified in individual sections, submit them at project closeout in compliance with requirements of Section 01 78 00 - Closeout Submittals:
1. Project record documents.
 2. Operation and maintenance data.
 3. Warranties.
 4. Bonds.
 5. Other types as indicated.
- D. Submit for Town of Canton's benefit during and after project completion.

3.11 NUMBER OF COPIES OF SUBMITTALS

- A. Electronic Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.
- B. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect.
1. After review, produce duplicates.
 2. Retained samples will not be returned to Contractor unless specifically so stated.

3.12 SUBMITTAL PROCEDURES

- A. General Requirements:
1. Use a single transmittal for related items.
 2. Transmit using approved form.
 - a. Use Contractor's form, subject to prior approval by Architect.
 3. Sequentially identify each item. For revised submittals use original number and a sequential numerical suffix.
 4. Identify: Project; Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.
 5. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.
 - a. Submittals from sources other than the Contractor, or without Contractor's stamp will not be acknowledged, reviewed, or returned.
 6. Deliver each submittal on date noted in submittal schedule, unless an earlier date has been agreed to by all affected parties, and is of the benefit to the project.
 - a. Send submittals in electronic format via email to Architect.
 7. Schedule submittals to expedite the Project, and coordinate submission of related items.

- a. For each submittal for review, allow 15 days excluding delivery time to and from the Contractor.
 - b. For sequential reviews involving Architect's consultants, Town of Canton, or another affected party, allow an additional 7 days.
 - c. For sequential reviews involving approval from authorities having jurisdiction (AHJ), in addition to Architect's approval, allow an additional 30 days.
8. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
9. Provide space for Contractor and Architect review stamps.
10. When revised for resubmission, identify all changes made since previous submission.
11. Distribute reviewed submittals. Instruct parties to promptly report inability to comply with requirements.
12. Incomplete submittals will not be reviewed, unless they are partial submittals for distinct portion(s) of the work, and have received prior approval for their use.
13. Submittals not requested will not be recognized or processed.
- B. Product Data Procedures:
 1. Submit only information required by individual specification sections.
 2. Collect required information into a single submittal.
 3. Do not submit (Material) Safety Data Sheets for materials or products.
- C. Shop Drawing Procedures:
 1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting Contract Documents and coordinating related work.
 2. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.
- D. Samples Procedures:
 1. Transmit related items together as single package.
 2. Identify each item to allow review for applicability in relation to shop drawings showing installation locations.

3.13 SUBMITTAL REVIEW

- A. Submittals for Review: Architect will review each submittal, and approve, or take other appropriate action.
- B. Submittals for Information: Architect will acknowledge receipt and review. See below for actions to be taken.
- C. Architect's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.
- D. Architect's and consultants' actions on items submitted for review:
 1. Authorizing purchasing, fabrication, delivery, and installation:
 - a. "Approved", or language with same legal meaning.
 - b. "Approved as Noted, Resubmission not required", or language with same legal meaning.
 - 1) At Contractor's option, submit corrected item, with review notations acknowledged and incorporated.
 - c. "Approved as Noted, Resubmit for Record", or language with same legal meaning.
 - 1) Resubmit corrected item, with review notations acknowledged and incorporated. Resubmit separately, or as part of project record documents.
 - 2) Non-responsive resubmittals may be rejected.
 2. Not Authorizing fabrication, delivery, and installation:
 - a. "Revise and Resubmit".
 - 1) Resubmit revised item, with review notations acknowledged and incorporated.
 - 2) Non-responsive resubmittals may be rejected.
 - b. "Rejected".

- 1) Submit item complying with requirements of Contract Documents.
- E. Architect's and consultants' actions on items submitted for information:
1. Items for which no action was taken:
 - a. "Received" - to notify the Contractor that the submittal has been received for record only.
 2. Items for which action was taken:
 - a. "Reviewed" - no further action is required from Contractor.

END OF SECTION

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SECTION 01 40 00 - QUALITY REQUIREMENTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

- A. Administrative and procedural requirements for quality assurance and quality control.
- B. Delegated design services.
- C. Conflicting requirements.
- D. 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.
 - 3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, Commissioning Authority, Construction Manager, Contractor or authorities having jurisdiction are not limited by provisions of this Section.
 - 4. Specific test and inspection requirements are not specified in this Section.

1.3 REFERENCE STANDARDS

- A. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection; 2025a.

1.4 REFERENCES

- A. Refer to specification Section 014100 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 DEFINITIONS

- A. 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.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.
- C. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.
- D. 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, to establish product performance and compliance with specified requirements.
- E. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.

- F. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- G. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- H. 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. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).
- I. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.6 DELEGATED-DESIGN SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
- B. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

1.7 CONFLICTING REQUIREMENTS

- A. Referenced Standards: 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. Refer conflicting requirements that are different, but apparently equal, to Architect for a 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 for a decision before proceeding.

1.8 ACTION SUBMITTALS

- A. Shop Drawings: For mockups, provide plans, sections, and elevations, indicating materials and size of mockup construction.
 - 1. Indicate manufacturer and model number of individual components.
 - 2. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

1.9 INFORMATIONAL SUBMITTALS

- A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.
- B. Qualification Data: For Contractor's quality-control personnel.
- C. Testing Agency Qualifications: 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.

1.10 CONTRACTOR'S QUALITY-CONTROL PLAN

- A. Quality-Control Plan, General: Submit quality-control plan within ten (10) days of Notice to Proceed, and not less than five (5) days prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities. Coordinate with Contractor's construction schedule.

- B. Quality-Control Personnel Qualifications: Engage qualified full-time personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.
 - 1. Project quality-control manager may also serve as Project Superintendent.
- C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.
- D. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:
 - 1. Contractor-performed tests and inspections including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections.
 - 2. Special inspections required by authorities having jurisdiction and indicated on the "Statement of Special Inspections."
 - 3. Owner-performed tests and inspections indicated in the Contract Documents, including tests and inspections indicated to be performed by the Commissioning Authority.
- E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring work into compliance with standards of workmanship established by Contract requirements and approved mockups.
- F. Monitoring and Documentation: Maintain testing and inspection reports including log of approved and rejected results. Include work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.11 QUALITY ASSURANCE

- A. Provide where required by Specifications.
- B. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- 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. 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.
- F. 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 in material, design, and extent to those indicated for this Project.
- G. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
 - 1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.
- H. Testing Agency Qualifications: An independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E329; and with

additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.

- I. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- J. 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.
- K. 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 (7) working days in advance of dates and times when mockups will be constructed.
 - 3. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed during the construction at Project.
 - 4. Demonstrate the proposed range of aesthetic effects and workmanship.
 - 5. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
 - a. Allow seven (7) days for initial review and each re-review of each mockup.
 - 6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 - 7. Demolish and remove mockups when directed unless otherwise indicated.
- L. Laboratory Mockups: Comply with requirements of preconstruction testing and those specified in individual Specification Sections in Divisions 02 through 49.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
 - 1. Provide materials and comply with installation requirements specified in other Specification Sections or match existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in specification section 01 70 00 - Execution.
- 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 41 00 - REGULATORY REQUIREMENTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 CODE REQUIREMENTS

- A. Perform all work on this Project in strict accordance with, but not limited to, applicable requirements and portions of the latest adopted editions of the currently adopted codes, revisions, amendments, supplements, and their references.
 - 1. International Building Code, 2018:
 - a. North Carolina State Building Code plus Amendments; 2018.
 - b. North Carolina State Building Code: Mechanical Code plus Amendments; 2018.
 - c. North Carolina State Building Code: Plumbing Code plus Amendments; 2018.
 - d. North Carolina State Building Code: Fire Prevention Code; 2018.
 - e. North Carolina State: Energy Code plus Amendments; 2018.
 - f. National Electrical Code: Plus North Carolina Amendments; 2020.
 - g. North Carolina State Building Code: Existing Building Code plus Amendments; 2018.
 - h. 2009 ICC/ANSI A A117.1 in accordance with the 2018 North Carolina State Building Code; (based on the 2015.)

1.3 CODE STANDARDS

- A. All work shall conform to applicable portions of the adopted, or the latest edition of the standards listed, which shall include, but is not limited to, the following:
 - 1. Aluminum Association (AA).
 - 2. American Association of Automatic Door Manufacturers (AAADM).
 - 3. American Concrete Institute (ACI).
 - 4. American Institute of Steel Construction (AISC).
 - 5. American National Standards Institute (ANSI).
 - 6. American Society for Testing and Materials (ASTM).
 - 7. American Society of Mechanical Engineers (ASME).
 - 8. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE).
 - 9. American Welding Society (AWS).
 - 10. Architectural Woodworking Institute (AWI).
 - 11. Architectural Aluminum Manufacturer's Association (AAMA).
 - 12. Commercial Standards (CS).
 - 13. Federal Specifications and Standards (FSS).
 - 14. Global Standards: International Organization for Standardization (ISO); ISO 9001 -Quality Management Systems.
 - 15. National Occupations Safety and Health Administration (OSHA).
 - 16. National Institute for Standards and Technology (NIST).
 - 17. Sheet Metal and Air Conditioning Contractor's National Association (SMACNA), Metal Finishes Manual for Architectural and Metal Products.
 - 18. Underwriter's Laboratories (UL).
 - 19. U.S. of America Standards Institute (ASI).
 - 20. U.S. Department of Commerce Product Standards (USDCPS).

1.4 REFERENCE STANDARDS

- A. Comply with applicable portions of the Refernced Standards listed in the FBC Chapter 35 and NFPA 1, Chapter 2 including but not limited to AAMA, ACI, AISC, ANSI, ASCE, ASHRAE, ASTM, FM, GA, OSHA, SJI, USGBC, ADA, IES, and UL standards.

1.5 CODE DISCREPANCIES

- A. In case of discrepancy between the codes, standards, and specifications listed, the strictest or most stringent requirement shall govern.

1.6 COMPLIANCE WITH CODES

- A. A permit issued will be construed as permission to proceed with construction, and not as authority to violate, cancel, alter, or set aside any of the provisions of any Codes.
- B. Nor shall issuance of a permit prevent the Owner from thereafter requiring a correction of errors in plans, construction, or violations of any Codes.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 01 42 00 - REFERENCES

PART 1 GENERAL

1.1 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.

1.2 SECTION INCLUDES

- A. General: This Section specifies procedural and administrative requirements for compliance with governing regulations and codes and standards imposed upon the Work. These requirements include the obtaining of permits, licenses, inspections, releases, and similar statements, as well as payments associated with regulations, codes, and standards.
- B. Governing Regulations: Refer to General and Supplementary Conditions for requirements related to compliance with governing regulations.

1.3 DEFINITIONS

- A. Refer to Section 01 42 16 - Definitions for the following terms:
 - 1. Approved.
 - 2. Directed.
 - 3. Furnish.
 - 4. Indicated.
 - 5. Install.
 - 6. Provide.
 - 7. Regulations.
 - 8. Testing Agencies.

1.4 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference. Individual Specification Sections indicate which codes and standards the Contractor must keep available at the project site for reference.
- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
- C. Conflicting Requirements: Where compliance with two or more standards is specified, and where these standards establish different or conflicting requirements for minimum quantities or quality levels, the most stringent requirement will be enforced, unless the Contract Documents specifically indicate a less stringent requirement. Refer requirements that are different, but apparently equal, and uncertainties as to which quality level is more stringent to the Architect for a decision before proceeding.
- D. Minimum Quantities or Quality Levels: In every instance the quantity or quality level shown or specified is intended to be the minimum for the Work to be provided or performed. Unless otherwise indicated, the actual Work may either comply exactly, within specified tolerances, with the minimum quantity or quality specified, or may exceed that minimum within reasonable limits. In complying with these requirements, the indicated numeric values are either minimum or maximum values, as noted, or as appropriate for context of the requirements. Refer instances of uncertainty to the Architect for decision before proceeding.

1.5 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the trade association, standards-producing organization, authorities having jurisdiction or other entity applicable to the context of the text provision.

- B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the Agency.
- C. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations.

1.6 SUBMITTALS

- A. Permits, Licenses and Certificates: For the Town of Canton's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, and similar documents, correspondence, and records established in conjunction with compliance with standards and regulations bearing upon performance of the Work.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 01 42 16 - DEFINITIONS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

- A. This section supplements the definitions contained in the General Conditions.
- B. Other definitions relate to terms used in individual specification sections.

1.3 CONTRACTING DEFINITIONS

- A. General: Basic Contract definitions included through 00 72 13 a - General Conditions include:
 - 1. Change Order.
 - 2. Construction Change Directive.
 - 3. Contract Documents.
 - 4. Contract.
 - 5. Drawings.
 - 6. Instruments of Service.
 - 7. Initial Decision Maker.
 - 8. Project.
 - 9. Specifications.
 - 10. Subcontractor.
 - 11. Substantial Completion.
 - 12. Work.
- B. Miscellaneous Other Definitions:
 - 1. Addenda, Addendum.
 - 2. Alternate Proposal(s).
 - 3. Approved, Approved Equivalent, Approved Equal, or Equal.
 - 4. Base Proposal.
 - 5. Contract Time.
 - 6. Date of Agreement.
 - 7. Date of Commencement of the Work.
 - 8. Date of Final Completion.
 - 9. Day.
 - 10. Notice to Proceed.
 - 11. Provide.
 - 12. Punch List.
 - 13. Unit Prices.

1.4 DEFINITIONS

- A. AAADM: American Association of Automatic Door Manufacturers.
- B. Accessible: In accordance with the accessibility standard.
- C. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."
- D. Activation Device: A control that, when actuated, sends an electrical signal to the door operator to open the door.

- E. 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 Activity: An activity on the critical path that 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.
- F. ADA-ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines."
- G. Adaptable Laboratory Furniture System: Modular furniture assemblies consisting of individual components, including: support structures; cabinets and storage units; worksurfaces; shelving; accessories.
- H. Adequate Ventilation: Ventilation, including air circulation and air changes, required for curing materials, dissipate humidity, and prevent accumulation of dust fumes, vapors, or gases.
- I. Adhesives: All gunnable, trowelable, liquid-applied, and aerosol adhesives, whether specified or not; including flooring adhesives, resilient base adhesives, and pipe jointing adhesives.
- J. AEES: Refer to Architecturally-Exposed Structural Steel.
- K. Alteration Work: Remodeling, renovation, repair, and maintenance work performed within existing spaces or on existing surfaces as part of the Project.
- L. 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 Town of Canton 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. Alternates described are part of the Work when enumerated in the Agreement.
 - 2. 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.
- M. Anchorage Connector: A component or subsystem that functions as an interface between the anchorage and a fall protection, work positioning, rope access, or rescue system for the purpose of coupling the system to the anchorage.
Architect/Engineer (A/E):
- N. Architectural Woodwork: Custom millwork that includes wood furring, blocking, shims, and hanging strips for installing woodwork items, unless concealed within other construction before woodwork installation.
- O. Architecturally-Exposed Structural Steel (AEES): Structural steel complying with designated AEES category as defined in AISC 303.
 - 1. Category 1 AEES: AEES that is within 96 inches vertically and 36 inches horizontally of a walking surface and that is visible to a person standing on that walking surface or is designated as "Category 1 architecturally exposed structural steel" or "AEES-1" in the Contract Documents.
 - 2. Category 2 AEES: AEES that is within 20 feet vertically and horizontally of a walking surface and that is visible to a person standing on that walking surface or is designated as "Category 2 architecturally exposed structural steel" or "AEES-2" in the Contract Documents.
 - 3. Category 3 AEES: AEES that is not defined as Category 1 or Category 2 or that is designated as "Category 3 architecturally exposed structural steel" or "AEES-3" in the Contract Documents or that is indicated to receive intumescent mastic fireproofing.

- P. **Approved:** The term "approved," when used in conjunction with the Architect's action on the Contractor's submittals, applications, and requests, is limited to the Architect's duties and responsibilities as stated in the Conditions of the Contract.
- Q. **Basis of Design (BOD) [Document]:** A document that records the concepts, calculations, decisions, and product selections used to meet the Owner's Project Requirements and to satisfy applicable regulatory requirements, standards and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process.
- R. **Basis of Design (BoD) [Product]:** A product selected by the designer to define the characteristics around which the project is designed.
- S. **Basis of Design Product Specification:** A specification in which a specific manufacturer's product is named and accompanied by the words "Basis of Design Product", including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other manufacturers named in the specification.
- T. **Bio-Based Material:** Commercial or industrial products (other than food or feed) that are composed in whole, or in significant part, of biological products, renewable agricultural materials (including plant, animal, and marine materials), or forestry materials. For the purposes of LEED, this excludes leather and other animal hides.
- U. **Boards or Strips:** Lumber of less than [2] inches ([50.8] mm) nominal size in least dimension.
- V. **Casework:** Products including, but not limited to framework, doors, drawers, hardware, and finishes which constitute cabinets and cases.
1. **Concealed:** Sleepers, web frames, dust panels and other surfaces not generally visible after installation and cabinets less than 30 inches (762 mm) above finished floor.
 2. **Exposed:** Portions of casework visible when drawers and cabinet doors are closed, including end panels, bottoms of cases more than 42 inches (1.066 m) above finished floor, tops of cases less than 72 inches (1.82 m) above finished floor and all members visible in open cases or behind glass doors.
 3. **Semi-Exposed:** Portions of casework and surfaces behind solid doors, tops of cases more than 72 inches (1.828 m) above finished floor and bottoms of cabinets more than 30 inches (0.762 m) but less than 42 inches (1.066 m) above finished floor.
- W. **Cast Stone:** Refined architectural concrete building unit manufactured to simulate natural cut stone, used in unit masonry applications.
1. **Dry Cast Concrete Products:** Manufactured from zero slump concrete:
 - a. **Vibrant Dry Tamp (VDT) casting method** - Vibratory ramming of earth moist, zero slump concrete against a rigid mold until densely compacted.
 2. **Wet Cast Concrete Products:** Manufactured from measurable slump concrete:
 - a. **Wet casting method** - Manufactured from measurable slump concrete and vibrated into a mold until densely consolidated.
- X. **Certified Wood:** Wood based materials and products certified in accordance with Forest Stewardship Council's (FSC) Principles and Criteria for wood building components.
- Y. **Chain-of-Custody Certificates:** Certificates signed by manufacturers certifying that wood used to make products was obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001. Certificates shall include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body. A chain-of- custody certification is not required by distributors of a product that is individually labeled with the Forest Stewardship Council logo and manufacturer's chain of custody number. Chain of Custody certification requirements are determined by Forest Stewardship Council Chain of Custody Standard 40-004 v2-1.
- Z. **Clean:** Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.

- AA. **Commissioning (Cx):** A systematic process confirming that building systems have been installed, properly started, and consistently operated in strict accordance with the Project Documents, that all systems are complete and functioning in accordance with the Contract Documents at Substantial Completion, and the Contractor has provided the Owner adequate system documentation and training.
- BB. **Commissioning Authority (CxA):** Party having a contractual agreement with the Owner to provide third party commissioning services as defined herein under Commissioning Authority's Role and Responsibilities. Commissioning Authority may represent the Owner and is authorized to act on behalf of the Owner. The Commissioning Authority does not have authority to alter design or installation procedures without the written approval of the Owner or the design team.
- CC. **Comparable Product:** Product demonstrated and approved through submittal process, or where indicated as a produce substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- DD. **Composite Materials:** Materials made from two or more constituent materials with significantly different physical or chemical properties that, when combined, produce materials with characteristics different from the individual components.
- EE. **Composite Wood** (also referred to as "Engineered Wood"): Examples of Composite Wood are: particleboard; flake-board; plywood; fiberboard; MDF; agrifiber products; millwork substrates; flooring substrates; equipment backboards; door cores.
- FF. **Concealed Portions of Casework:** Include panels and other surfaces not usually visible after installation.
- GG. **Consolidate:** To strengthen loose or deteriorated materials in place.
- HH. **Construction Waste:** Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- II. **Containment Areas:** As determined by Owner's Representative and as shown on drawings. Includes area of construction, adjacent staging and storage areas, for contractors, supplies and waste: includes ceiling spaces above and adjacent to construction, if shown.
- JJ. **Contaminant Producing Activities:** Activities that include, but are not limited to:
1. Demolition and removal of walls, floors, ceilings, and other finish materials.
 2. Demolition of plumbing, mechanical and electrical systems and equipment.
 3. Finish operations such as sanding, painting, and application of special surface coatings.
 4. All routine construction activity which can generate dust.
 5. Sitework operations.
- KK. **Contract Documents:** The General Conditions, Drawings, Specifications, Addenda, and other documents developed by the A/E Team and approved by the Owner that constitute the contractual obligations of the project scope.
- LL. **Control Point and Sensor Calibration Verification:** Process of verifying the point integrity and/or sensor calibration from the physical point of monitoring (sensor, contact, actuator, etc.) to the digital point location at the Operator's interface within the respective control system (Building Automation, Lighting Controls, Power Status and Monitoring, etc.).
- MM. **Cost Loading:** The allocation of the schedule of values for the completion of an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum unless otherwise approved by Architect.
- NN. **Cradle-to-Gate Assessment:** Analysis of a product's partial life-cycle from extraction (cradle) to gate (factory completion prior to distribution).
- OO. **Critical Path:** The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.

- PP. **Critical Path Method (CPM):** A method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.
- QQ. **Custom Hollow Metal Work:** Hollow metal work fabricated according to ANSI/NAAMM-HMMA 861.
- RR. **Cutting:** Removal of existing construction necessary to permit installation or performance of other Work.
- SS. **Deconstruct:** To remove by disassembling or detaching an item from a surface, using methods and equipment to successfully prevent damage to the item and surfaces, and dispose of items unless indicated as salvaged or for reinstallation.
- TT. **Deferred Testing:** Functional Performance or Integrated System Tests performed after Substantial Completion due to partial occupancy, partial equipment acceptance, seasonal requirements, design, or other site conditions that prohibit the test from being performed prior to Substantial Completion.
- UU. **Deficiency:** Condition of a component, piece of equipment, or system that is not in compliance with the Project Documents.
- VV. **Demolition Waste:** Building and site improvement materials resulting from demolition or selective demolition operations.
- WW. **Design Reference Sample:** A sample that represents the Architect's prebid selection of Work to be matched; it may be existing Work or Work specially produced for the Project.
- XX. **Dimension Lumber:** Lumber of [2] inches ([50.8] mm) nominal or greater size but less than [5] inches ([127] mm) nominal size in least dimension.
- YY. **Directed:** A command or instruction by Architect. Other terms including "requested," "authorized", "selected", "required", and "permitted" have the same meaning as "directed."
- ZZ. **Disposal:** Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.
- AAA. **Double-Egress (Doors):** A pair of doors that simultaneously swing with the two doors moving in opposite directions with no mullion between them.
- BBB. **Double-Swing (Doors):** A pair of doors that swing with the two doors moving in opposite directions with a mullion between them; each door functioning as a single-swing door.
- CCC. **Drainable Blade Louver:** Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.
- DDD. **Engineered Wood:** Refer to Composite Wood.
- EEE. **Equipment:** A product with operational parts, regardless of whether motorized or manually operated, and in particular, a product that requires service connections such as wiring or piping.
- FFF. **Existing to Remain:** Leave existing items that are not scheduled for salvage or reuse, as is; do not remove.
- GGG. **Experienced:** When used with an entity or individual, experienced means having successfully completed a minimum of five years documented experience with projects similar in nature, size, and extent; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction. Exposed Portions of Casework: Bottoms of casework more than two feet above floor shall be considered as exposed. Visible members in open cases also shall be considered as exposed portions.
- HHH. **Face Size:** Actual tile size, excluding spacer lugs.
- III. **Fall Arrest System:** A system designed to stop you in the process of a fall, typically including an anchor point or series of anchor points, a safety lanyard or self-retracting lifeline, and a harness.
- JJJ. **Fall Protection System:** System can be either a fall arrest or a fall restraint system.

- KKK. **Fall Restraint System:** A system designed to keep you from getting close enough to the fall hazard to fall, typically including an anchor point or series of anchor points, a safety lanyard or self-retracting lifeline, and a harness.
- LLL. **Fiber-Reinforced Polymer (FRP):** Material that consists of polymer resin-based matrix with fibers of either glass, carbon or aramid, and hybrid combinations of these fiber types.
- MMM. **Field Quality Control Testing:** Tests and inspections performed onsite for work scheduled to be performed and upon completed Work.
- NNN. **File Transfer Protocol (FTP):** Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.
- OOO. **Float:** The measure of leeway in starting and completing an activity.
1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
 2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
 3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.
- PPP. **Formaldehyde:** Naturally occurring VOC, found in small amounts in animals and plants; carcinogenic and irritant to humans when present in high concentrations. (Levels above 0.1 ppm).
1. Urea Formaldehyde: Combination of urea and formaldehyde, used in glue, and readily decomposes at room temperature.
 2. Phenolformaldehyde: Type of formaldehyde that off gasses only at high temperature; used for exterior products and suitable for interior applications.
- QQQ. **Forest Stewardship Council (FSC) Certified Content:** Permanently installed wood content that has been harvested in accordance from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship." Recycled wood fiber that qualifies as contributing to MR Credit 4 (Recycled Content) is excluded from FSC Certified Content.
- RRR. **Functional Performance Test (FPT):** Test of dynamic function and operation of equipment and systems executed by the Contractor and witnessed by the CxA. Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, life safety conditions, power failure, etc. Systems are operated through all specified sequences of operation. Components are verified to be responding in accordance with requirements in the Project Documents.
- SSS. **Functional Performance Testing Procedures:** Commissioning protocols, detailed test procedures and instructions in tabular and script-type format that fully describe system configuration and steps required to determine if the system is performing and functioning properly.
- TTT. **Furnish:** To supply, deliver, unload, and inspect for damage.
- UUU. **Glass Manufacturers:** Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- VVV. **Glass Thicknesses:** Indicated by thickness designations in millimeters according to ASTM C 1036.
- WWW. **General:** Considering or including the main features or elements of something, and disregarding exceptions; overall.
- XXX. **General Emissions Evaluation:** To comply with low-emitting material criteria, building products must be tested and determined compliant in accordance with California Department of

Public Health (CDPH) Standard Method v1.2–2017mg/, using the applicable exposure scenario. Manufacturers' claims of compliance with the above requirements must also state the range of total VOCs after 14 days (336 hours), measured as specified in the CDPH Standard Method v1.2: 0.5 mg/cu. m or less; between 0.5 and 5.0 mg/cu. m; or 5.0 mg/cu. m or more.

YYY. **Green Building Certification Institute (GBCI):** An organization that provides third-party credentialing and verification for several rating systems relating to the built environment

ZZZ. **Hazardous:** Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.

AAAA. **Hazardous Materials:** Material regulated as hazardous material in accordance with 49 CFR 173, requiring Material Safety Data Sheet (MSDS) in accordance with 29 CFR 1910.1200, or which during end use, treatment, handling, storage, transportation, or disposal meets or has components which meet or have the potential to meet the definition of a Hazardous Waste in accordance with 40 CFR 261. Hazardous material includes hazardous chemicals.

1. Hazardous materials include but are not limited to pesticides, biocides, and carcinogens listed by the Environmental Protection Agency (EPA) and International Agency for Research on Cancer (IARC) and recognized authorities.

BBBB. **Horizontal Louver:** Louver with horizontal blades (i.e., the axes of the blades are horizontal).

CCCC. **Indicated:** Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown", "noted", "scheduled", and "specified" have the same meaning as "indicated."

DDDD. **Integrated Systems Test (IST):** Test of dynamic function and operation of multiple systems. Integrated Systems Tests are tested under various modes, such as fire alarm and emergency situations, life safety conditions, power failure, etc. Systems are integrally operated through all specified sequences of operation. Systems and interconnections are verified to be responding in accordance with the requirements in the Project Documents.

EEEE. **Integrated Systems Testing Procedures:** Commissioning protocols and detailed test procedures and instructions in tabular and script-type format that fully describe system configurations and steps required to determine if the interacting systems are performing and functioning properly.

FFFF. **Install:** To unpack, assemble, erect, apply, place, finish, cure, protect, clean, start up, and make ready for use.

GGGG. **Installer/Applicator/Erector:** Construction or another entity engaged by Construction Manager as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.

1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).

HHHH. **IBC:** International Building Code.

IIII. **Indicated:** Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown", "noted", "scheduled", and "specified" have the same meaning as "indicated."

JJJJ. **Indoor Air Quality (IAQ):** Composition and characteristics of air in an enclosed space affecting occupants of space. The indoor air quality refers to relative quality of air in a building with respect to contaminants and hazards and is determined by levels of indoor air pollution and characteristics of air, including those that impact thermal comfort such as air temperature, relative humidity, and air speed.

KKKK. **Informational Submittals:** Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with

requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

LLLL.

MMMM. **Integrated Systems Test (IST):** Test of dynamic function and operation of multiple systems. Integrated Systems Tests are tested under various modes, such as fire alarm and emergency situations, life safety conditions, power failure, etc. Systems are integrally operated through all specified sequences of operation. Systems and interconnections are verified to be responding in accordance with the requirements in the Project Documents.

NNNN. **Integrated Systems Testing Procedures:** Commissioning protocols and detailed test procedures and instructions in tabular and script-type format that fully describe system configurations and steps required to determine if the interacting systems are performing and functioning properly.

OOOO. **Interior Final Finishes:** Materials and products exposed at interior, occupied spaces including flooring, wallcovering, finish carpentry, and ceilings.

PPPP. **Install:** Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

QQQQ. **Installer/Applicator/Erector:** Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform particular construction operations, including installation, erection, application, and similar operations.

1. The term "experienced," when used with the term "installer," means having successfully completed a minimum of 5 previous projects similar in size and scope to this Project; being familiar with the special requirements indicated; and having complied with requirements of authorities having jurisdiction.
2. Trades: Using terms 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.
3. Assigning Specialists: Certain Sections of the Specifications require that specific construction activities shall be performed by specialists who are recognized experts in those operations. The specialists must be engaged for those activities, and their assignments are requirements over which the Contractor has no option. However, the ultimate responsibility for fulfilling contract requirements remains with the Contractor.
 - a. This requirement shall not be interpreted to conflict with enforcing building codes and similar regulations governing the Work.

RRRR. **Interior (of Building):** Within the weatherproof membrane.

SSSS. **Interspace:** Space between lites of an insulating-glass unit.

TTTT. **Interior:** Within the weatherproof membrane.

UUUU. **Leadership in Engery and Environmental Design (LEED):** USGBC's "LEED Version 4 for Building Design and Construction."

1. Definitions that are a part of "LEED Version 4 and 4.1 for Building Design and Construction" (LEED v4 and v4.1 BD+C) apply to this Section.

VVVV. **LEED Online:** GBCI's online portal for project certification documentation.

WWWW. **Knowing act:** Consciously initiating the opening of a power operated door using acceptable methods including wall mounted switches such as push plates and controlled access devices such as keypads, card readers and key switches.

XXXX. **Lead Equivalence:** The thickness of lead that provides the same attenuation (reduction of radiation passing through) as the material in question under the specified conditions.

YYYY. **Leadership in Energy and Environmental Design (LEED):** USGBC's Building Rating System

1. Refer to the applicable LEED Reference Guide for additional definitions.

ZZZZ. **LEED Online:** GBCI's online portal for project certification documentation.

AAAAA. **LEED Project Administrator:** Responsible for administration of LEED Certification Application.

BBBBB. **Life-Cycle Inventory:** Database that defines environmental input and output for each step in a material or assembly's life cycle.

CCCCC. **Lifeline:** A component of a fall protection system consisting of a flexible line designed to hang vertically, a vertical lifeline, or connecting to anchorages or anchorage connectors at both ends to span horizontally, a horizontal lifeline.

DDDDD. **Look-Ahead Schedule:** Prepare schedule indicating activities scheduled to occur or commence prior to submittal of next schedule update.

EEEE. **Louver Terminology:** Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.

FFFFF. **Match:** To blend with adjacent construction and manifest no apparent difference in material type, species, cut, form, detail, color, grain, texture, or finish; as approved by Architect.

GGGGG. **Materials:** Products which must be substantially cut, shaped, worked, mixed, finished, refined, or otherwise fabricated, processed, or installed to form units of work.

HHHHH. **MERV:** Minimum Efficiency Reporting Value: Arrestance rating of filter at three MERV Rating Explanation particle sizes of 0.3 microns to 10 microns at a determined face velocity.

IIIII. **Milestones:** measurable and observable and serve as progress markers (flags) but, by definition, are independent of time (have zero durations) therefore no work or consumption of resources is associated with them.

JJJJJ. **Millwork:** Ready-made wood products manufactured at a wood-planing mill or woodworking plant: moldings, doors, door frames, window sashes, stair work, cabinets, etc. excluding flooring, ceilings, and sidings.

KKKKK. **Minimum Thickness:** Minimum thickness of base metal without coatings.

LLLLL. **"Minor"** ceiling access is defined as visual observation or minor adjustments or other activity that does not disturb dust. Acoustical panels shall be replaced or access panel shall be closed immediately when the contractor leaves the work site.

1. "Major" ceiling access describes any other access not defined as "minor".

MMMMM. **Mobile Cabinet:** Free-standing base cabinet storage device mounted on casters or glides.

NNNNN. **Mock-Up:** Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.

1. **Laboratory Mock-Up:** Full-size physical assemblies constructed at testing facility to verify performance characteristics.
2. **Integrated Exterior Mock-Up:** Mockups of the exterior envelope erected separately from the building but on Project site, consisting of multiple products, assemblies, and subassemblies.
3. **Room Mock-Up:** Mockups of typical interior spaces complete with wall, floor, and ceiling finishes, doors, windows, millwork, casework, specialties, furnishings and equipment, and lighting.

OOOOO. **Module Size:** Actual tile size plus joint width indicated.

PPPPP. **Named Products:** Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.

QQQQQ. **Negative Air Machine:** Portable mechanical units to provide a negative air pressure in the Containment Areas.

RRRRR. **New Products:** Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.

SSSSS. **Non-Hazardous:** Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.

TTTTT. **Non-Toxic:** Neither immediately poisonous to humans nor poisonous after a long period of exposure.

UUUUU. **Operational Testing:** Activities and testing occurring after initial energizing and/or start-up of equipment that determine whether equipment is operating within the manufacturer's recommendations and the design requirements. These activities are intended to ensure that equipment and systems meet all warranty requirements and are ready for Functional Performance Testing. Common examples are Testing, Adjusting and Balancing of HVAC systems and initial load testing of electrical equipment.

VVVVV. **Owner's Project Requirements (OPR):** A written document that details the functional requirements of a project and the expectations of how the facility will be used and operated. These include project goals, measurable performance criteria, cost considerations, benchmarks, success criteria and supporting information.

WWWWW. **Owner's Project Requirements (OPR):** A written document that details the functional requirements of a project and the expectations of how the facility will be used and operated. These include project goals, measurable performance criteria, cost considerations, benchmarks, success criteria and supporting information.

XXXXX. **Packaged Dry Products:** Materials and products installed in dry form and delivered in manufacturer's packaging; including carpets, resilient flooring, ceiling tiles, and insulation.

YYYYY. **Patching:** Fitting and repair Work required to restore surfaces to original conditions after installation of other Work.

ZZZZZ. **Pencil Copy:** A preliminary review copy of the application for payment for review by Architect and Owner prior to submission of final copy.

AAAAA. **Permanent Enclosure:** As determined by Architect, permanent or temporary roofing is complete, insulated, and weathertight; exterior walls are insulated and weathertight; and all openings are closed with permanent construction or substantial temporary closures.

BBBBB. **Permeable Surface:** Surfaces which allow storm water to pass through and infiltrate the soil below.

CCCCC. **Plastic Composites, or Wood-Plastic Composites:** Composite materials made primarily from wood- or cellulose-based materials and plastics.

DDDDD. **Portable Document Format (PDF):** An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

EEEEEE. **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.

FFFFFF. **Product:** Item obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material", "equipment", "system", "assembly", and terms of similar intent.

1. **Comparable Product:** A product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
2. **Named Products:** Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature current as of date of the Contract Documents.
3. **Specified Products:** Same as Named Products.
4. **New Products:** Items that have not previously been incorporated into another project or facility, except products consisting of recycled-content materials are allowed, unless explicitly stated otherwise. Products salvaged or recycled from other projects are not considered new products.

GGGGGG. **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, to establish product performance and compliance with specified requirements.

HHHHHH. **Project Documents:** Consists of the Contract Documents, Approved Submittals, Requests for Information (RFI), Vendor documentation, Operations and Maintenance (O&M) information and other documentation that determines the requirements for acceptable installation and operation of the specific equipment and systems on the project.

IIIIII. **Product:** Material, machinery, components, equipment, fixtures, and systems forming the work result. Not materials or equipment used for preparation, fabrication, conveying, or erection and not incorporated into the work result. Products may be new, never before used, or re-used materials or equipment.

JJJJJJ. **Project Manual:** The book-sized volume that includes the procurement requirements (if any), the contracting requirements, and the specifications.

KKKKKK. **Project Site:** Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

LLLLLL. **Products:** Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material", "equipment", "system", "assembly", and terms of similar intent.

MMMMMM. **Protection Areas:** As determined by Owner's Representative and as shown on drawings as Protection areas. Includes hospital areas adjacent to Containment Area, either occupied or used for passage, as well as areas connected to construction area by mechanical system air intake, exhaust and ductwork.

NNNNNN. **Provide:** Furnish and install, complete and ready for the intended use.

OOOOOO. **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.

PPPPPP. **Quality-Control Services:** Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.

QQQQQQ. **Rapidly Renewable Materials:** Materials and products made from plants that are typically harvested within a 10-year or shorter cycle.

RRRRRR. **Recovery Schedule:** Submittal of a revised critical path method (CPM) schedule and a written plan.

SSSSSS. **Recycle:** Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

TTTTTT. **Recycled Content:** Defined in accordance with the International Organization of Standards document ISO 14021, Environmental labels and declarations, Self-declared environmental claims (Type II environmental labeling).

1. **Postconsumer Recycled Material:** Material generated by households or by commercial, industrial, and institutional facilities in their role as end users of the product, which can no longer be used for its intended purpose.
2. **Preconsumer Recycled Material:** Material diverted from the waste stream during the manufacturing process. Excluded is reutilization of materials, such as rework, regrind, or scrap, generated in a process and capable of being reclaimed within the same process that generated it.

UUUUUU. **Refinish:** To remove existing finishes to base material and apply new finish to match original, or as otherwise indicated.

VVVVVV. **Regional Materials:** Materials that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles (160 km) of Project site. If only a fraction of a product or material is extracted/harvested/recovered and manufactured locally, then only that percentage (by weight) shall contribute to the regional value.

1. Green Globes requirement for Regionally Extracted, Harvested, or Recovered Materials: Materials that are extracted, harvested, or recovered and manufactured within a radius of [500] miles ([804.67] kilometers) from the Project site.
2. Green Globes requirements for Regionally Manufactured Materials: Materials that are manufactured within a radius of [500] miles ([804.67] kilometers) from the Project location. Manufacturing refers to the final assembly of components into the building product that is installed at the Project site.

WWWWWW. **Regulations:** Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

XXXXXX. **Reinforced Masonry:** Masonry containing reinforcing steel in grouted cells.

YYYYYY. **Remove:** Detach items from existing construction and dispose off-site unless indicated as salvaged or reinstallation.

ZZZZZZ. **Remove and Salvage:** Detach items from existing construction, in a manner to prevent damage and turn over to owner.

AAAAAA. **Repair:** To correct damage and defects, retaining existing materials, features, and finishes. This includes patching, piecing-in, splicing, consolidating, or otherwise reinforcing or upgrading materials.

BBBBBB. **Replace:** To remove, duplicate, and reinstall entire item with new material. The original item is the pattern for creating duplicates unless otherwise indicated.

CCCCCC. **Replicate:** To reproduce in exact detail, materials, and finish unless otherwise indicated.

DDDDDD. **Reproduce:** To fabricate a new item, accurate in detail to the original, and from either the same or a similar material as the original, unless otherwise indicated.

EEEEEE. **Request for interpretation (RFI):** A request seeking one of the following:

1. An interpretation, amplification, or clarification of some requirement of Contract Documents arising from inability to determine from them the exact material, process, or system to be installed; or when the elements of construction are required to occupy the same space (interference); or when an item of work is described differently at more than one place in Contract Documents.
2. A resolution to an issue which has arisen due to field conditions and affects design intent.

FFFFFF. **Resource Loading:** The allocation of manpower and equipment necessary for completion of an activity as scheduled.

- GGGGGGG. **Retain:** To keep existing items that are not to be removed or dismantled.
- HHHHHHH. **Return:** To give back reusable items or unused products to vendors for credit.
- IIIIII. **Reuse:** To reuse a construction waste material in some manner on the project site.
- JJJJJJJ. **Safety Device:** A control that, to avoid injury, prevents a door from opening or closing, as appropriate.
- KKKKKKK. **Salvage:** Recovery of demolition or construction waste and subsequent sale or reuse in another facility.
- LLLLLLL. **Salvage and Reuse:** Recovery of demolition or construction waste and subsequent incorporation into the Work.
- MMMMMMM. **Scheduling Specialist (SS):** An internal or third party entity contracted to the Owner providing scheduling advice (if applicable).
- NNNNNNN. **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.
- OOOOOOO. **Scheduling Specialist (SS):** An internal or third party entity contracted to the Owner providing scheduling advice (if applicable).
- PPPPPPP. **Sealants:** All gunnable, trowelable, and liquid-applied joint sealants and sealant primers, whether specified or not; including firestopping sealants and duct joint sealers.
- QQQQQQQ. **Sediment:** Soil and other debris that has been eroded and transported by storm or well production run-off water.
- RRRRRRR. **Semi-Exposed Portions of Casework:** Include those members such as divisions, interior faces of ends, case back, backs and bottoms.
- SSSSSSS. **Solar Reflectance Index (SRI):** The measure of a constructed surface's ability to stay cool in the sun by reflecting solar radiation and emitting thermal radiation. SRI values range from zero (solid black surface) to 100 (solid white surface). SRI value of a material is calculated according to ASTM E1980 and based on the aged, tested values of solar reflectance and thermal emittance.
- TTTTTTT. **Source Quality-Control Testing:** Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.
- UUUUUUU. **Source Separation:** Separating waste materials from the time they become waste.
- VVVVVVV. **Sealants:** All gunnable, trowelable, and liquid-applied joint sealants and sealant primers, whether specified or not; including firestopping sealants and duct joint sealers.
- WWWWWWW. **Specified Products:** Products listed as to be supplied as specified.
- XXXXXXX. **Standard Hollow Metal Work:** Hollow metal work fabricated according to ANSI/SDI A250.8.
- YYYYYYY. **Start-Up:** The activities where equipment is initially energized, tested and operated. Start-up is completed prior to Operational Testing and Functional Performance Testing and is an integral item documented in the System Verification Checklist (SVC).
- ZZZZZZZ. **Strip:** To remove existing finish down to base material unless otherwise indicated.
- AAAAAAA. **Submittal:** Written and graphic information and physical samples that require Architect's responsive action or are for information and do not require the architect's action.
1. **Action Submittal:** Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."
 2. **Informational Submittals:** Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with

requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

BBBBBBBB. **Substitutions:** Changes from the Contract Document requirements proposed by the CONTRACTOR after the award of the Contract. Changes include products, assemblies, materials, equipment, and methods of construction. Proposed substitutions by the CONTRACTOR are considered to be requests for substitutions. Substitutions will be considered by the OWNER as a special request.

1. Substitutions for Cause: Proposed substitutions due to changed Project circumstances beyond Contractor's control, such as unavailability or regulatory changes.
2. Substitutions for Convenience: Proposed substitutions due to possibility of offering substantial advantage to the Project.
3. The following are not considered to be requests for substitutions:
 - a. Substitutions requested during the bidding period, and accepted by Addendum prior to award of the Contract, are included in the Contract Documents and are not subject to requirements for substitutions listed in Section "Substitution Procedures."
 - b. Revisions to the Contract Documents requested by the OWNER.
 - c. Specified options of products and construction methods included in Contract Documents.
 - d. The CONTRACTOR'S determination of and compliance with governing regulations and orders issued by governing authorities.

CCCCCCCC. **Subsystem:** A portion of a system with characteristics similar to a system.

DDDDDDDD. **Supply:** Same as Furnish.

EEEEEEEE. **System:** An organized collection of parts, equipment, or subsystems united by regular interaction.

FFFFFFF. **System Verification Checklist (SVC):** List of static inspections and material or component tests that verify proper installation of equipment (e.g., belt tension, oil levels, labels affixed, gages in place, sensors calibrated, etc.), start-up activities and documentation, as well as operational testing results. The checklists are meant to document all activities for an individual piece of equipment from procurement on the project through operational testing are performed in accordance with the requirements in the project documents.

GGGGGGGG. **Testing:**

1. Field Quality Control Testing: Tests and inspections performed on site for installation of the Work and for completed Work.
2. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.
3. 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, to establish product performance and compliance with specified requirements.
4. Source Quality Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.

HHHHHHHH. **Testing Agency:** An independent entity engaged to perform specific inspections or tests, either at the Project Site or elsewhere, and to report on and, if required, to interpret results of those inspections or tests.

IIIIIIII. **Testing Laboratory:** Refer to Testing Agency.

JJJJJJJ. "Thorough" cleaning of surfaces: Cleaning of surfaces which become exposed to dust shall be accomplished by the use of either a HEPA filtered vacuum cleaner or a wet mop.

KKKKKKKK. **Toxic:** Poisonous to humans either immediately or after a long period of exposure.

LLLLLLLLL. **Training Plan:** A detailed plan prepared by the Contractor and reviewed by the Owner and Commissioning Authority that outlines the training activities, instructors, time durations, and system requirements in accordance with the Contract Documents and Commissioning Plan.

MMMMMMMM. **Trending:** Data collection of monitored points using the Building Automation System, Lighting Controls System, Power Status and Monitoring System or independent data acquisition instrumentation.

NNNNNNNN. **Unit price** is an amount incorporated in the Agreement, applicable during the duration of the Work as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

OOOOOOOO. **Vertical Illuminance:** Illuminance levels calculated at a point on a vertical surface or plane.

PPPPPPPP. **Vertical Louver:** Louver with vertical blades (i.e., the axes of the blades are vertical).

QQQQQQQQ. **Visual Display Board Assembly:** Visual display surface that is factory fabricated into composite panel form, either with or without a perimeter frame.

RRRRRRRR. **Visual Display Surface:** Surfaces that are used to convey information visually, including surfaces of markerboards and surfacing materials that are not fabricated into composite panel form but are applied directly to walls.

SSSSSSSS. **Volatile Organic Compound (VOC):** A carbon compound that vaporizes at normal room temperatures.

TTTTTTTT. **Waste:** Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

UUUUUUUU. **Wet Products:** Materials and products installed in wet form, including paints, sealants, adhesives, and special coatings.

VVVVVVVV. **Wind Driven Rain Resistant Louver:** Louver that provides specified wind driven rain performance determined by testing according to AMCA 500-L.

WWWWWWWW. **Wood-Plastic Composites:** Refer to Plastic Composites.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

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SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications and the Sections included under Division 01, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

- A. This Section includes requirements for construction facilities and temporary controls, including temporary utilities, support facilities, and security and protection.
- B. Temporary utilities.
- C. Temporary sanitary facilities.
- D. Temporary Controls: Barriers, enclosures, and fencing.
- E. Security requirements.
- F. Vehicular access and parking.
- G. Waste removal facilities and services.
- H. Project identification sign.
- I. Field offices.

1.3 REFERENCES

- A. Refer to specification Section 014100 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.4 TEMPORARY UTILITIES

- A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities engaged in the Project to use temporary services and facilities without cost, including, but not limited to, Architect, testing agencies, and authorities having jurisdiction.
- B. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.
- C. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

1.5 TEMPORARY SANITARY FACILITIES

- A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.
- B. Maintain daily in clean and sanitary condition.

1.6 INFORMATIONAL SUBMITTALS

- A. Fire-Safety Program: Show compliance with requirements of NFPA 241, "Standard for Safeguarding Construction, Alteration, and Demolition Operations", and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.

1.7 BARRIERS

- A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.

- B. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing building.
- C. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.8 FENCING

- A. Provide 6 foot (1.8 m) high fence around construction site; equip with vehicular and pedestrian gates with locks.

1.9 SECURITY

- A. Provide security and facilities to protect Work, existing facilities, and Town of Canton's operations from unauthorized entry, vandalism, or theft.

1.10 VEHICULAR ACCESS AND PARKING

- A. Coordinate access and haul routes with governing authorities and Town of Canton.
- B. Provide and maintain access to fire hydrants, free of obstructions.
- C. Provide means of removing mud from vehicle wheels before entering streets.
- D. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.

1.11 WASTE REMOVAL

- A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.
- B. Provide containers with lids. Remove trash from site periodically.
- C. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.12 PROJECT SIGNS

- A. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.
 - 1. Identification Signs: Provide a 4 x 4 post supported 4 x 8 wood color graphic project identification sign including, but not limited to, the project name, rendering of project, and logos from Town of Canton, the General Contractor, and Architect. A design for the sign will be provided by the Architect once the project is awarded.
 - 2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to the Project.
 - a. Provide temporary, directional signs for construction personnel and visitors.
 - 3. Maintain and touch up signs so they are always legible.

1.13 FIELD OFFICES

- A. Office: Weathertight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture, drawing rack, and drawing display table.
- B. Provide space for Project meetings, with table and chairs to accommodate 6 persons.
- C. Locate offices a minimum distance of 30 feet (10 m) from existing structures.

PART 2 PRODUCTS

2.1 TEMPORARY FACILITIES, SITE USAGE, AND PROTECTIONS

- A. Common-Use Field Office – The Owner will allow the contractor to use the stage within the existing auditorium to be used as a field office. Owner, Architect, and Contractor meetings may be held in the Owner's neighboring annex building.
- B. Site Usage - A safety and security barrier on the outside of the building shall be provided around the construction laydown area. The Contractor shall coordinate the location of the laydown area, construction deliveries, and construction parking.

- C. Equipment Protection – HVAC, electrical, plumbing, and theatrical Systems (includes rigging, lighting, and audio visual) shall be protected during construction activities. Dust protection should be provided to prevent damage to these critical systems.
- D. Historic Architectural Features Protection – Provide barriers as required to protect the exterior and interior historical features from being damaged during construction.

2.2 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

PART 3 EXECUTION

3.1 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.
 - 1. Where access to adjacent properties is required to affect the protection of existing facilities, obtain written permission from adjacent property owner to access property for that purpose.
- B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
 - 1. Comply with work restrictions specified in Section 01 10 00 "Summary."
- C. Stormwater Control: Comply with the requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.
- D. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of birds, rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using materials approved by authorities having jurisdiction.
- E. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people from easily entering laydown area(s) except by a gate.
 - 1. Extent of Fence: As required to enclose a portion determined sufficient to accommodate construction operations.
- F. Retain "Security Enclosure and Lockup" Paragraph below because enclosure fence does not always provide adequate security against theft and vandalism.
- G. Security Enclosure and Lockup: Install temporary enclosures around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at the end of each workday.
- H. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- I. Egress: Maintain egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.

3.2 MOISTURE AND MOLD CONTROL

- A. Contractor's Moisture-Protection Plan: Describe delivery, handling, storage, installation, and protection provisions for materials subject to water absorption or water damage.
 - 1. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water-damaged Work.
 - 2. Indicate methods to be used to avoid trapping water in finished work.

- B. Partially Enclosed Construction Period: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:
1. Keep interior spaces reasonably clean and protected from water damage.
 2. Periodically collect and remove waste containing cellulose or other organic matter.
 3. Discard or replace water-damaged material.
 4. Do not install material that is wet.
 5. Discard and replace stored or installed material that begins to grow mold.
 6. Perform work in a sequence that allows wet materials adequate time to dry before enclosing the material in gypsum board or other interior finishes.

END OF SECTION

SECTION 01 60 00.0 - PRODUCT REQUIREMENTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

- A. Administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; comparable products and substitutions.

1.3 DEFINITIONS

- A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
 - 2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
 - 3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.
- C. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Construction Manager.
 - 1. Substitutions for Cause: Changes proposed by Construction Manager that are required due to changed Project conditions, such as unavailability of product, or regulatory changes.
 - 2. Substitutions for Convenience: Changes proposed by Construction Manager or Owner that are not required in order to meet other Project requirements but may offer advantage to Construction Manager or Owner.

1.4 REFERENCES

- A. Refer to specification Section 014100 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 ACTION SUBMITTALS

- A. See Section 013000 – Administrative Requirements and Section 016000 – Product Requirements for submittal procedures.
- B. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Substitution Request Form:
 - a. Use facsimile of form provided in Project Manual.
 - b. Use CSI form 13.1 A

2. Include complete information as required in the Substitution Form. Incomplete information will result in automatic rejection of the substitution request.
3. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
 - a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
 - b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and Construction Managers, that will be necessary to accommodate proposed substitution.
 - c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
 - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 - e. Samples, where applicable or requested.
 - f. Certificates and qualification data, where applicable or requested.
 - g. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
 - h. Detailed comparison of Construction Manager'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 date of receipt of purchase order, lack of availability, or delays in delivery.
 - i. Construction Manager's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
 - j. Construction Manager's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
 - k. Cost information, including a proposal of change for a credit to the owner, if any, in the Contract Sum.
 - l. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with requirements.
 - m. Submittals not requested will not be recognized or processed.
4. 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 Construction Manager of acceptance or rejection of proposed substitution within fifteen (15) days of receipt of request, or seven (7) days of receipt of additional information or documentation, whichever is later.
 - a. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.6 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.
 1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
 2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

- B. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.7 PROCEDURES

- A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

1.8 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
 - 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
 - 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
 - 3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
 - 4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.
- C. Storage:
 - 1. Store products to allow for inspection and measurement of quantity or counting of units.
 - 2. Store materials in a manner that will not endanger Project structure.
 - 3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
 - 4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
 - 5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
 - 6. Protect stored products from damage and liquids from freezing.
 - 7. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.9 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
 - 1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
 - 2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
 - 1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
 - 2. See other Sections for specific content requirements and particular requirements for submitting special warranties.

PART 2 PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
 - 1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
 - 2. 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.
 - 3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
 - 4. Where products are accompanied by the term "as selected," Architect will make selection.
 - 5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
 - 6. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.
- B. Product Selection Procedures:
 - 1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 - 2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 - 3. Products:
 - a. Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.
 - b. Non-restricted List: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.
 - 4. Manufacturers:
 - a. PART 7 Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.
 - b. Non-restricted List: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.
 - 5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.
- C. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.

1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Specification Section "Substitution Procedures" for proposal of product.
- D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 SUBSTITUTIONS

- A. 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 is consistent with the Contract Documents and will produce indicated results.
 2. Substitution request is fully documented and properly submitted.
 - a. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
 - 1) Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
 - 2) Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and Construction Managers, that will be necessary to accommodate proposed substitution.
 - 3) Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
 - 4) Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 - 5) Samples, where applicable or requested.
 - 6) Certificates and qualification data, where applicable or requested.
 - 7) Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
 - 8) Detailed comparison of Construction Manager'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 date of receipt of purchase order, lack of availability, or delays in delivery.
 - 9) Construction Manager's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
 - 10) Construction Manager's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
 - 11) Cost information, including a proposal of change for a credit to the owner, if any, in the Contract Sum.
 - 12) Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with requirements.
 - 13) Submittals not requested will not be recognized or processed.
 3. Requested substitution will not adversely affect Contractor's construction schedule.

4. Requested substitution has received necessary approvals of authorities having jurisdiction.
 5. Requested substitution is compatible with other portions of the Work.
 6. Requested substitution has been coordinated with other portions of the Work.
 7. Requested substitution provides specified warranty.
 8. 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.
- B. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than fifteen (15) days prior to time required for preparation and review of related submittals.
1. 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:
 - a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - b. Substitution request is fully documented and properly submitted.
 - c. Requested substitution will not adversely affect Contractor's construction schedule.
 - d. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - e. Requested substitution is compatible with other portions of the Work.
 - f. Requested substitution has been coordinated with other portions of the Work.
 - g. Requested substitution provides specified warranty.
 - h. 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. Substitutions for Convenience: Not allowed unless otherwise indicated.
- D. Substitutions for Convenience: Architect will consider requests for substitution if received ten (10) days prior to Bid and within thirty (30) days after the Notice to Proceed. Requests received after that time may be considered or rejected at discretion of Architect.
1. 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:
 - a. 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.
 - b. Requested substitution does not require extensive revisions to the Contract Documents.
 - c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - d. Substitution request is fully documented and properly submitted.
 - e. Requested substitution will not adversely affect Contractor's construction schedule.
 - f. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - g. Requested substitution is compatible with other portions of the Work.
 - h. Requested substitution has been coordinated with other portions of the Work.
 - i. Requested substitution provides specified warranty.
 - j. 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.
 - k. Additional requirements as indicated on the Substitution Request Form.

PART 3 EXECUTION

3.1 OWNER-SUPPLIED PRODUCTS

- A. See Section 01 10 00 - Summary for identification of Town of Canton-supplied products.
- B. Town of Canton's Responsibilities:
 - 1. Arrange for and deliver Town of Canton reviewed shop drawings, product data, and samples, to Contractor.
 - 2. Arrange and pay for product delivery to site.
 - 3. On delivery, inspect products jointly with Contractor.
 - 4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
 - 5. Arrange for manufacturers' warranties, inspections, and service.
- C. Contractor's Responsibilities:
 - 1. Review Town of Canton reviewed shop drawings, product data, and samples.
 - 2. Receive and unload products at site; inspect for completeness or damage jointly with Town of Canton.
 - 3. Handle, store, install and finish products.
 - 4. Repair or replace items damaged after receipt.

END OF SECTION

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SECTION 01 60 00.1 - REQUEST FOR SUBSTITUTION FORM

PROJECT INFORMATION

PROJECT NAME AND NUMBER: _____

CONTRACT AWARD DATE: _____

TO: _____

SUBSTITUTION REQUESTED BY: _____

REQUEST MADE DURING:

_____ Bidding

_____ Construction Period

CAUSE FOR REQUEST: _____

SUBSTITUTION INFORMATION

SUBMIT IN ACCORDANCE WITH SECTION 01 33 00 - SUBMITTAL PROCEDURES.

1. Technical data, cost, and time information relating to changes to Construction Documents required by proposed substitution.
2. Detailed comparison of proposed substitution and specified product including but not limited to warranty, significant variations, qualifications of manufacturers, and maintenance.
3. Complete technical data, detailed shop drawings, samples, installation procedures, warranty, and substantiating data marked to indicate equivalent quality and performance to that specified. Manufacturer sell sheets are not acceptable submittals.

BASIS OF DESIGN

Specified Manufacturer: _____

Specified Product: _____

Where Specified:

Drawing (Sheet Number and Detail/Schedule): _____

Specification: (Section Number and Paragraph): _____

PROPOSED SUBSTITUTION

We submit for consideration the following manufacturer / product in lieu of the specified item for the above referenced project:

Proposed Manufacturer: _____

Years in Business: _____

Proposed Product: _____

COST AND TIME

Does proposed substitution affect adjacent work, Construction Documents, Cost, Schedule, Quality, or related submittals?

_____ No

_____ Yes

Contractor is responsible for costs and additional time associated with proposed substitution including costs incurred by Architect for evaluation of substitution and changes to the documents. Describe costs for changes to design, including engineering and detailing costs caused by requested substitution.

Cost Savings Realized by Town of Canton (\$ US):

WARRANTY

Is warranty for proposed substitution the same as for specified product?

_____ Yes

_____ No

If No, Explain Differences: _____

CONTRACTOR CERTIFICATION:

In making this request for substitution, Contractor certifies that:

1. Proposed substitution has been thoroughly researched and evaluated and determined as equivalent or superior to specified product or material, will fit into space provided, and is compatible with adjacent materials.
2. Proposed substitution does not affect dimensions and or details shown on the Drawings.
3. Proposed substitution does not have any affect on other Contracts or other Trades.
4. Proposed substitution does not have any affect on the construction schedule.
5. Proposed substitution will provide the same or better warranty at no additional cost to the Town of Canton and service and maintenance parts are readily available after installaiton is complete.
6. Cost data is complete and includes related costs under the Contract. Claims for additional costs related to the proposed substitution that may subsequently become apparent are waived.
7. Contractor will assume responsibility for delays and costs caused by acceptance proposed substitution, if approved, are accepted by the Contractor unless delays and costs are specifically mentioned and approved in writing by Town of Canton and Architect.
8. Contractor will assume liability for performance of the substitution.
9. Installation of the proposed substitution is coordinated with the Work and with changes required to the Work.
10. Contractor will pay for any and all changes to the building design, including engineering and detailing costs caused by an approved substitution.
11. Contractor will reimburse Town of Canton and Architect for evaluation and redesign services associated with the substitution request and, when required, for approval by authorities having jurisdiction.

PREVIOUS USE

Has the proposed substitute manufacturer / product been installed on previous Craig Gaulden Davis | PBK projects within the past two years?

_____ No

_____ Yes

If Yes, list project(s):

Project: _____

Contact: _____

Project: _____

Contact: _____

SUBMITTED BY:

Contractor's Signature: _____

Signature shall be by the individual authorized to legally bind the Contractor to the above terms. Failure to provide legally binding signature will result in retraction of acceptance.

Firm: _____

Telephone: _____ Date: _____

SUBSTITUTION EVALUATION

FOR USE BY ARCHITECT:

___ Accepted ___ Accepted as Noted ___ Not Accepted ___ Received too Late

By: _____ Date: _____

Remarks: _____

FOR USE BY TOWN OF CANTON:

___ Accepted ___ Not Accepted

By: _____ Date: _____

Remarks: _____

END OF SECTION

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Project:	{Insert Project Name}	Date:	MM/DD/YYYY
Project Number:	12345	Contractor:	{Insert Contractor Name} {Insert Contractor's Address} {Insert Contractor's Address}
Architect of Record:	Harvard Jolly PBK {Insert Office Address} {Insert Office Address}		

Digital Data refers to electronic representation of information, drawings, and designs created and stored in digital form including Building Information Modeling (BIM) files, CAD files, and other formats that are digital representations of the project. Harvard Jolly | PBK will provide the following {Revit / CAD} dated {MM/DD/YYYY} for the convenience of the Contractor after purchase of the building.

Digital Data were prepared on the following:

Computer Hardware/Operating System – {Microsoft Windows 10}

Software Application and Version – {type here}

Contractor shall pay Harvard Jolly | PBK a service fee of \$00.00.

TERMS & CONDITIONS

- Harvard Jolly | PBK makes no representation as to the compatibility of the Digital Data with any hardware or software.
- Since the information set forth on the Digital Data can be modified unintentionally or otherwise, Harvard Jolly | PBK reserves the right to remove all indicia of its ownership and/or involvement from each electronic display.
- All information on the digital data is considered Instruments of Service of Harvard Jolly | PBK and shall not be used for other projects, for additions to this project, or completion of this project by others. The Digital Data shall remain the property of Harvard Jolly | PBK and in no case shall the transfer of these files be considered a sale.
- Harvard Jolly | PBK makes no representation regarding the accuracy, completeness, or permanence of the Digital Data, or for their merchantability or fitness for a particular purpose. Addenda information or revisions made after the date indicated on the Digital Data may not have been incorporated. In the event of a conflict between Harvard Jolly | PBK's sealed contract drawings and the Digital Data, the sealed contract drawings shall govern. It is the Contractor's responsibility to determine if any conflicts exist. The Digital Data shall not be considered to be Contract Documents as defined by the General Conditions of the Contract for Construction.
- The use of Digital Data prepared by Harvard Jolly | PBK shall not in any way obviate the Contractor's responsibility for the proper checking and coordination of dimensions, details, and quantities of materials as required to facilitate complete and accurate fabrication and erection.
- The Contractor shall, to the fullest extent permitted by law, indemnify, defend, and hold harmless Harvard Jolly | PBK and its consultants from all claims, damages, losses, expenses, penalties, and liabilities of any kind, including attorney's fees, arising out of or resulting from the use of the Digital Data by the Contractor, or by third party recipients of the Digital Data from the Contractor.
- Harvard Jolly | PBK believes that no licensing or copyright fees are due to others on account of the transfer of the Digital Data, but to the extent any are, the Contractor will pay the appropriate fees and hold Harvard Jolly | PBK harmless from such claims.
- Payment of the service fee is due upon receipt of the Digital Data.

Name & Title (Architect)

Name & Title (Contractor)

Signature

Date

Signature

Date

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SECTION 01 70 00 - EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

- A. Examination, preparation, and general installation procedures.
- B. Pre-installation meetings.
- C. Surveying for laying out the work.
- D. Cleaning and protection.
- E. Starting of systems and equipment.
- F. Demonstration and instruction of Town of Canton personnel.
- G. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.
- H. General requirements for maintenance service.

1.3 REFERENCES

- A. Refer to specification Section 014000 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.4 SUBMITTALS

- A. See Section 013000 – Administrative Requirements and Section 016000 – Product Requirements for submittal procedures.
- B. Project Record Documents: Accurately record actual locations of capped and active utilities.

1.5 PROJECT CONDITIONS

- A. Use of explosives is not permitted.
- B. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
- C. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.
 - 1. Provide dust-proof enclosures to prevent entry of dust generated outdoors.
 - 2. Provide dust-proof barriers between construction areas and areas continuing to be occupied by Town of Canton.
- D. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.

PART 2 PRODUCTS

2.1 PATCHING MATERIALS

- A. New Materials: As specified in product sections; match existing products and work for patching and extending work.
- B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.
- C. Substitutions: See Section 016000 - Product Requirements for substitution procedures.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.
- B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.
- C. Examine and verify specific conditions described in individual specification sections.
- D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.
- E. Verify that utility services are available, of the correct characteristics, and in the correct locations.
- F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.2 PREPARATION

- A. Clean substrate surfaces prior to applying next material or substance.
- B. Seal cracks or openings of substrate prior to applying next material or substance.
- C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.3 PREINSTALLATION MEETINGS

- A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.
- B. Require attendance of parties directly affecting, or affected by, work of the specific section.
- C. Notify Architect four days in advance of meeting date.
- D. Prepare agenda and preside at meeting:
 - 1. Review conditions of examination, preparation and installation procedures.
 - 2. Review coordination with related work.
- E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Town of Canton, participants, and those affected by decisions made.

3.4 GENERAL INSTALLATION REQUIREMENTS

- A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.
- B. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- C. 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.
- D. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.
- E. Tools and Equipment: Where possible, select tools or equipment that minimize production of excessive 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 portions of the Work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

- G. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
 - 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. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.
- J. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.
- K. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.
- L. Make neat transitions between different surfaces, maintaining texture and appearance.
- M. Repair or remove and replace damaged, defective, or nonconforming Work.
 - 1. Comply with Section 01 77 00 "Closeout Procedures" for repairing or removing and replacing defective Work.

3.5 CUTTING AND PATCHING

- A. Whenever possible, execute the work by methods that avoid cutting or patching.
- B. Perform whatever cutting and patching is necessary to:
 - 1. Complete the work.
 - 2. Fit products together to integrate with other work.
 - 3. Provide openings for penetration of mechanical, electrical, and other services.
 - 4. Match work that has been cut to adjacent work.
 - 5. Repair areas adjacent to cuts to required condition.
 - 6. Repair new work damaged by subsequent work.
 - 7. Remove samples of installed work for testing when requested.
 - 8. Remove and replace defective and non-complying work.
- C. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.
- D. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.
- E. Restore work with new products in accordance with requirements of Contract Documents.
- F. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- G. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 84 00, to full thickness of the penetrated element.
- H. Patching:
 - 1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
 - 2. Match color, texture, and appearance.

3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

3.6 PROGRESS CLEANING

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
- B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
- C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
- D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

3.7 PROTECTION OF INSTALLED WORK

- A. Protect installed work from damage by construction operations.
- B. Provide special protection where specified in individual specification sections.
- C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
- D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
- E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- G. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

3.8 SYSTEM STARTUP

- A. Coordinate schedule for start-up of various equipment and systems.
- B. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.
- C. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
- D. Verify that wiring and support components for equipment are complete and tested.
- E. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.
- F. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.9 DEMONSTRATION AND INSTRUCTION

- A. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at scheduled time, at equipment location.
- B. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
- C. Provide a qualified person who is knowledgeable about the Project to perform demonstration and instruction of Owner's personnel.

3.10 ADJUSTING

- A. Adjust operating products and equipment to ensure smooth and unhindered operation.

3.11 FINAL CLEANING

- A. Use cleaning materials that are nonhazardous.
- B. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.
- C. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.
- D. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
- E. Clean filters of operating equipment.
- F. Clean debris from roof and gutters.
- G. Clean site; sweep paved areas, rake clean landscaped surfaces.
- H. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.12 CLOSEOUT PROCEDURES

- A. Make submittals that are required by governing or other authorities.
- B. Notify Architect when work is considered ready for Architect's Substantial Completion inspection.
- C. Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's Substantial Completion inspection.
- D. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect.
- E. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Town of Canton-occupied areas.
- F. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.
- G. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.

3.13 MAINTENANCE

- A. Provide service and maintenance of components indicated in specification sections.
- B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.
- C. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.
- D. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.
- E. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Town of Canton.

END OF SECTION

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SECTION 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

- A. Administrative and procedural requirements for the following:
 - 1. Disposing of non-hazardous waste.

1.3 DEFINITIONS

- A. Refer to Section 01 42 16 - Definitions for the following terms:
 - 1. Construction Waste.
 - 2. Demolition Waste.
 - 3. Disposal.
 - 4. Recycle.
 - 5. Salvage.
 - 6. Salvage and Reuse.

1.4 REFERENCES

- A. Refer to specification Section 014100 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 QUALITY ASSURANCE

- A. Waste Management Coordinator Qualifications: Firm having minimum 10 years documented experience in specializing in waste management coordination.
- B. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

1.6 PERFORMANCE REQUIREMENTS

- A. Conform to applicable regulations regarding Solid Waste Control.
- B. Practice efficient waste management in the use of materials in the course of the Work.

1.7 WASTE MANAGEMENT PLAN

- A. Develop a waste management plan and requirements.
 - 1. Submit plan within 20 days of date established for Notice to Proceed.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 PLAN IMPLEMENTATION

- A. Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract:
 - 1. Comply with operation, termination, and removal requirements in Section 01 50 00 - Temporary Facilities and Controls.
- B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan.
- C. Site Access and Temporary Controls:
 - 1. Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities:

- a. Comply with Section 01 50 00 - Temporary Facilities and Controls for the control of dust and dirt, environmental protection, and noise control.

3.2 DISPOSAL OF WASTE

- A. Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction:
 - 1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Burning: Do not burn waste materials.
- C. Disposal: Remove waste materials and dispose of at designated spoil areas on Town of Canton's property.

END OF SECTION

SECTION 01 77 00 - CLOSEOUT PROCEDURES

PART 1 GENERAL

1.1 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.

1.2 SECTION INCLUDES

- A. Administrative and procedural requirements for contract closeout, including, but not limited to, the following:
 - 1. Substantial Completion procedures.
 - 2. Final completion procedures.
 - 3. Final cleaning.
 - 4. Repair of the Work.

1.3 REFERENCES

- A. Refer to specification Section 014100 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.4 ACTION SUBMITTALS

- A. See Section 013000 – Administrative Requirements and Section 016000 – Product Requirements for submittal procedures.
- B. Product Data: For each type of cleaning agent.
- C. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
- D. Certified List of Incomplete Items: Final submittal at final completion.

1.5 CLOSEOUT SUBMITTALS

- A. Certificates of Release: From authorities having jurisdiction.
- B. Certificate of Insurance: For continuing coverage.
- C. Field Report: For pest control inspection.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.7 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.
- B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - 1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - 2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
 - 3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.

4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number.
 5. Submit testing, adjusting, and balancing records.
 6. Submit sustainable design submittals not previously submitted.
 7. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
- C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
1. Advise Owner of pending insurance changeover requirements.
 2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
 3. Complete startup and testing of systems and equipment.
 4. Perform preventive maintenance on equipment used prior to Substantial Completion.
 5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 01 79 00 "Demonstration and Training."
 6. Advise Owner of changeover in utility services.
 7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
 8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
 9. Complete final cleaning requirements.
 10. Touch up paint and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
 2. Results of completed inspection will form the basis of requirements for final completion.

1.8 FINAL COMPLETION PROCEDURES

- A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:
1. Submit a final Application for Payment according to Section 01 29 00 "Payment Procedures."
 2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
 4. Submit pest-control final inspection report.
 5. Submit final completion photographic documentation.
- B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled

requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.9 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
 1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
 2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
 3. Include the following information at the top of each page:
 - a. Project name.
 - b. Date.
 - c. Name of Architect.
 - d. Name of Contractor.
 - e. Page number.
 4. Submit list of incomplete items in the following format:
 - a. MS Excel electronic file. Architect will return annotated file.

1.10 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where warranties are indicated to commence on dates other than date of Substantial Completion, or when delay in submittal of warranties might limit Owner's rights under warranty.
- B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.
- C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
- D. Warranties in Paper Form:
 1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch (215-by-280-mm) paper.
 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
 3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
- E. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 EXECUTION

3.1 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
 - 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
 - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Rake grounds that are not planted, mulched, or paved to a smooth, even-textured surface.
 - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - e. Remove snow and ice to provide safe access to building.
 - f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 - g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 - h. Sweep concrete floors broom clean in unoccupied spaces.
 - i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
 - j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
 - k. Remove labels that are not permanent.
 - l. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
 - n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 - o. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
 - p. Clean luminaires, lamps, globes, and reflectors to function with full efficiency.
 - q. Leave Project clean and ready for occupancy.
- C. Pest Control: Comply with pest control requirements in Section 01 50 00 "Temporary Facilities and Controls." Prepare written report.
- D. Construction Waste Disposal: Comply with waste disposal requirements in Section 01 50 00 "Temporary Facilities and Controls."

3.2 REPAIR OF THE WORK

- A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.
- B. Repair, or remove and replace, defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting

operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.

1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that already show evidence of repair or restoration.
 - a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION

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SECTION 01 78 00 - CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

- A. Project record documents.
- B. Operation and maintenance documentation directory manuals.
- C. Emergency manuals.
- D. Operation and maintenance data.
- E. Operation and maintenance data for materials and finishes.
- F. Operation and maintenance data for equipment and systems.
- G. Warranties and bonds.

1.3 SUBMITTALS

- A. Project Record Documents: Submit documents to Architect with claim for final Application for Payment.
- B. Operation and Maintenance Data:
 - 1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect will review draft and return one copy with comments.
 - 2. For equipment, or component parts of equipment put into service during construction and operated by Town of Canton, submit completed documents within ten days after acceptance.
 - 3. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
 - 4. Submit two sets of revised final documents in final form within 10 days after final inspection.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 PROJECT RECORD DOCUMENTS

- A. Maintain on site one set of the following record documents; record actual revisions to the Work:
 - 1. Drawings.
 - 2. Specifications.
 - 3. Addenda.
 - 4. Change Orders and other modifications to the Contract.
 - 5. Reviewed shop drawings, product data, and samples.
 - 6. Manufacturer's instruction for assembly, installation, and adjusting.
- B. Ensure entries are complete and accurate, enabling future reference by Town of Canton.
- C. Store record documents separate from documents used for construction.
- D. Record information concurrent with construction progress.
- E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
 - 1. Manufacturer's name and product model and number.
 - 2. Product substitutions or alternates utilized.
 - 3. Changes made by Addenda and modifications.

- F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
 - 1. Field changes of dimension and detail.
 - 2. Details not on original Contract drawings.

3.2 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY MANUAL

- A. Operation and Maintenance Documentation Directory:
 - 1. Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals. List items and their location to facilitate ready access to desired information. Include the following:
 - a. List of systems and subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
 - b. List of equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
 - c. Tables of contents: Include a table of contents for each emergency, operation, and maintenance manual.

3.3 EMERGENCY MANUALS

- A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Town of Canton's operating personnel for types of emergencies indicated.
- B. Content:
 - 1. Organize manual into a separate section for each of the following:
 - a. Type of emergency.
 - b. Emergency instructions.
 - c. Emergency procedures.
- C. Type of Emergency:
 - 1. Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
 - a. Flood.
 - b. Gas leak.
 - c. Water leak.
 - d. Power failure.
 - e. Water outage.
 - f. System, subsystem, or equipment failure.
 - g. Chemical release or spill.
- D. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Town of Canton's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.
- E. Emergency Procedures:
 - 1. Include the following, as applicable:
 - a. Instructions on stopping.
 - b. Shutdown instructions for each type of emergency.
 - c. Operating instructions for conditions outside normal operating limits.
 - d. Required sequences for electric or electronic systems.
 - e. Special operating instructions and procedures.

3.4 OPERATION AND MAINTENANCE DATA

- A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.
- B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

- C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.
- D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.5 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

- A. For Each Product, Applied Material, and Finish:
 - 1. Product data, with catalog number, size, composition, and color and texture designations.
 - 2. Information for re-ordering custom manufactured products.
- B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.
- C. Moisture protection and weather-exposed products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.
- D. Additional information as specified in individual product specification sections.
- E. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

3.6 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

- A. For Each Item of Equipment and Each System:
 - 1. Description of unit or system, and component parts.
 - 2. Identify function, normal operating characteristics, and limiting conditions.
 - 3. Include performance curves, with engineering data and tests.
 - 4. Complete nomenclature and model number of replaceable parts.
- B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.
- C. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.
- D. Include color coded wiring diagrams as installed.
- E. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
- F. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
 - 1. Include HVAC outdoor and exhaust air damper calibration strategy.
 - a. Include provisions which ensure that full closure of dampers can be achieved.
 - 2. Include Carbon Dioxide Monitoring Protocol.
 - 3. Include Carbon Monoxide Monitoring Protocol.
 - 4. Include Frost Mitigation Strategy for ventilation heat-recovery system.
- G. Provide servicing and lubrication schedule, and list of lubricants required.
- H. Include manufacturer's printed operation and maintenance instructions.
- I. Include sequence of operation by controls manufacturer.
- J. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

- K. Provide control diagrams by controls manufacturer as installed.
- L. Provide Contractor's coordination drawings, with color coded piping diagrams as installed.
- M. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- N. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- O. Include test and balancing reports.
- P. Additional Requirements: As specified in individual product specification sections.

3.7 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

- A. Assemble operation and maintenance data into durable manuals for Town of Canton's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.
- B. Where systems involve more than one specification section, provide separate tabbed divider for each system.
- C. Binders: Commercial quality, 8-1/2 by 11 inch (216 by 280 mm) three D side ring binders with durable plastic covers; 2 inch (50 mm) maximum ring size. When multiple binders are used, correlate data into related consistent groupings.
- D. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.
- E. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.
- F. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.
- G. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.
- H. Text: Manufacturer's printed data, or typewritten data on 20 pound paper.
- I. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- J. Arrangement of Contents: Organize each volume in parts as follows:
 - 1. Project Directory.
 - 2. Table of Contents, of all volumes, and of this volume.
 - 3. Operation and Maintenance Data: Arranged by system, then by product category.
 - a. Source data.
 - b. Operation and maintenance data.
 - c. Field quality control data.
 - d. Photocopies of warranties and bonds.
 - 4. Design Data: To allow for addition of design data furnished by Architect or others, provide a tab labeled "Design Data" and provide a binder large enough to allow for insertion of at least 20 pages of typed text.

3.8 WARRANTIES

- A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where warranties are indicated to commence on dates other than date of Substantial Completion, or when delay in submittal of warranties might limit Owner's rights under warranty.
- B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

- C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
- D. Warranties in Paper Form:
 - 1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch (215-by-280-mm) paper.
 - 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
 - 3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
- E. Provide additional copies of each warranty to include in operation and maintenance manuals.

END OF SECTION

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SECTION 024113 - SELECTIVE SITE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

- A. This section covers all work associated with the demolition and removal of site features as indicated on the drawings, as specified herein and as otherwise required to accomplish other work associated with the contract.

1.2 LUMP SUM PRICE

- A. The items listed in the proposal shall be considered sufficient to complete the work in accordance with the plans and specifications. Any portion of the work not specifically listed in the bid form shall be deemed a part of the item with which it is associated and shall be included in the lump sum price. The price shall be full compensation for all labor, materials, and equipment necessary to properly demolish and dispose of off-site all facilities shown to be removed on the construction plans and as specified herein including any testing, construction supervision and all other work required for satisfactory completion of site demolition operations.
- B. Base bids on the following criteria:
 - 1. Explosives shall not be brought to the site.
 - 2. Burning will not be allowed.
 - 3. Contractor is responsible for permits, fees and licenses.

1.3 UNIT PRICES

- A. None in this Section.

1.4 SUBMITTALS

- A. None this section.

1.5 REGULATORY REQUIREMENTS

- A. Comply with Federal, State, and local demolition, hauling and disposal regulations.

1.6 QUALITY ASSURANCE

- A. Materials: All material submittals shall be submitted by the contractor and reviewed and accepted in writing by the Engineer prior to ordering of any materials.
- B. Manufacturer: Material and equipment shall be the standard products of a manufacturer who has manufactured them for a minimum of 2 years and who provides published data on the quality and performance of the projects.
- C. Subcontractor: A subcontractor for any part of the work must have experience with similar work. At the option of the Owner and/or Engineer, a list of projects and the contacts who are familiar with his competence may be required to be submitted to verify experience.
- D. Equipment: Shall be well maintained, suited for the intended work and capable of delivering the finished product to the standards shown on drawings and as specified herein.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 DEMOLITION

- A. Demolish structures completely, safely, and remove from the site using methods required by governing regulations. Small structures may be removed intact when acceptable to the Owner and Authorities Having Jurisdiction (AHJ).

- B. Proceed with demolition in a systematic manner.
- C. Demolish concrete and masonry in small sections. Break up and remove concrete slabs-on-grade unless otherwise shown to remain.
- D. Demolish and remove below grade construction and concrete slabs on completely.
- E. Provide full depth sawcuts through all pavements to be removed. Sawcuts shall be neat, straight, and vertical.
- F. Demolish and remove below grade utilities completely unless indicated otherwise.
 - 1. Utility structures indicated to be abandoned in place shall be removed to a depth of 2 feet below grade, the bottom broken, and the structure filled with controlled fill or flowable fill.
 - 2. Utility pipes indicated to be abandoned in place shall be filled with flowable fill.
 - 3. The volume of flowable fill required to completely fill the pipe and/or structure shall be calculated prior to placement. The volume of flowable fill discharged shall be equal to the volume required.

3.2 FILLING BASEMENTS AND VOIDS

- A. Ensure that areas to be filled are free of standing water, frost, frozen material, trash, and debris prior to fill placement.
- B. Grade surface to match adjacent grades and to provide flow to surface drainage structures after fill placements and compaction.

3.3 DISPOSAL OF DEMOLISHED MATERIALS

- A. Dispose of demolished materials in accordance with current Federal, State, and local regulations. All cost in connection with disposing of demolished materials will be the responsibility of the Contractor.
- B. Do not burn any material, debris, or trash on site.

3.4 PROTECTIONS

- A. Ensure safe passage of persons around all areas.
- B. Conduct operations to prevent damage to adjacent buildings, structures, or other facilities, trees, vegetation, or injury to persons, etc.
- C. Promptly repair damage caused to adjacent facilities by demolition operations at no additional cost to the Owner.
- D. Maintain existing utilities indicated to remain, keep in service, and protect against damage during demolition and/or relocation operations.
- E. Prevent interruption of existing utilities serving occupied or used facilities, except when authorized in writing by AHJ.
- F. Provide temporary services during interruptions to existing utilities as acceptable to Owner and AHJ.
- G. Before initiating demolition, make arrangements for relocating, disconnecting, rerouting, abandoning, or similar action as may be required relative to utilities and other underground piping, to permit work to proceed without delay. Arrangements shall be made in accordance with the regulations of authorities of utilities concerned, including, but not limited to overhead and underground power and telephone lines and equipment, gas piping, storm sewers, sanitary sewers, or water piping. The Contractor shall not use water when it may create hazardous or objectionable conditions, such as ice, flooding, and/or pollution.

- H. Use water sprinkling and other suitable methods to limit dust and dirt rising and scattering into the air to lowest practical level.
- I. Comply with governing regulations pertaining to environmental protection.

3.5 INSPECTIONS

- A. Notify the Owner, Project Representative and Engineer a minimum of 72 hours prior to all required observations, inspections, or tests.
- B. All work conducted and materials furnished shall be subject to review by the Engineer or the Project Representative. The Engineer will also have the right to require that any portion of the work be conducted in his presence.
 - 1. If the work is covered after such instruction, it shall be exposed by the Contractor for observation.
 - 2. However, if the Engineer is notified that such work is scheduled and the Engineer fails to appear within 72 hours, the Contractor may proceed without him.
- C. All improper work shall be reconstructed and all materials which do not conform to the requirements of the specifications shall be removed from the work upon written notice.
 - 1. The Engineer shall have the right to mark materials as rejected to distinguish them as such.

3.6 ACCEPTANCE

- A. Final acceptance will be based on a satisfactory demolition as approved by the Owner and/or Engineer.
- B. Demolition work shall be re-worked to the satisfaction of the Owner and/or Engineer until specified requirements are met. All additional work which is the result of a failed inspection or test shall be performed by the Contractor at no additional cost to the Owner.

END OF SECTION 024113

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SECTION 02 41 19 - SELECTIVE DEMOLITION

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES:

- A. Provide labor, material, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
 - 1. Demolition and removal of selected portions of building or structure.
 - 2. Demolition and removal of selected site elements.

1.3 REFERENCE STANDARDS

- A. Comply with NFPA 1 – Chapter 16 and NFPA 241 Standard for Safeguarding Construction Alteration and Demolition Operation Latest Adopted Edition.

1.4 REFERENCES

- A. Refer to specification Section 014100 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 DEFINITIONS

- A. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For refrigerant recovery technician.
- B. Engineering Survey: Submit engineering survey of condition of building.
- C. Proposed Protection Measures: Submit report, including drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control and, for noise control. Indicate proposed locations and construction of barriers.
- D. Schedule of Selective Demolition Activities: Indicate the following:
 - 1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's building manager's on-site operations are uninterrupted.
 - 2. Interruption of utility services. Indicate how long utility services will be interrupted.
 - 3. Coordination for shutoff, capping, and continuation of utility services.
 - 4. Use of elevator and stairs.
- E. Pre-demolition Photographs or Video: Show existing conditions of adjoining construction, including finish surfaces that might be misconstrued as damage caused by demolition operations.

1.7 PRE-DEMOLITION MEETING

- A. The Contractor shall conduct a pre-demolition meeting at the project site a minimum of 30 days prior to any work being installed as indicated in this section and other related sections that require coordination with this section.
 - 1. Inspect and discuss condition of construction to be selectively demolished.
 - 2. Review structural load limitations of existing structure.
 - 3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
 - 5. Review areas where existing construction is to remain and requires protection.
 - 6. Review and finalize protection requirements.

7. Review procedures for noise control and dust control.
8. Review procedures for protection of adjacent buildings.

1.8 QUALITY ASSURANCE

- A. Demolition Firm: Company specializing in performing the Work of this Section with minimum five years documented experience.
- B. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

1.9 FIELD CONDITIONS

- A. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- B. Notify Architect of discrepancies between existing conditions and drawings before proceeding with selective demolition.
- C. Storage or sale of removed items or materials on-site is not permitted.
- D. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
- E. Arrange selective demolition schedule so as not to interfere with Owner's operations.

1.10 HAZARDOUS MATERIALS

- A. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner.
- B. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
 1. Hazardous materials will be removed by Owner before start of the Work.
 2. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.
- C. Hazardous Materials: Present in buildings and structures to be selectively demolished. A report on the presence of hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.
 1. Hazardous material remediation is specified elsewhere in the Contract Documents.
 2. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified elsewhere in the Contract Documents.
 3. Owner will provide material safety data sheets for suspected hazardous materials that are known to be present in buildings and structures to be selectively demolished because of building operations or processes performed there.

1.11 PROJECT RECORD DOCUMENTS

- A. Accurately record actual locations of capped utilities, subsurface obstructions, and structures.

1.12 SALVAGE

- A. The Owner has the first right to salvage reusable equipment.
- B. The Contractor shall salvage indicating items for reuse in the project.
- C. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations. Comply with specification section "Photographic Documentation."
- D. Salvage: Items indicated to be removed for salvaged:
 1. Clean salvaged items of dirt and demolition debris.
 2. Store items in a secure area until delivery to Owner.
 3. Protect items from damage during transport and storage.
- E. The following items are to be salvage for reuse in the project:

1.13 PERFORMANCE REQUIREMENTS

- A. Standards: Comply with ASSE A10.6 and NFPA 241.
- B. Conform to applicable codes for demolition of structures, safety of adjacent structures, dust control, runoff, and erosion control, and disposal of demolished materials.
- C. Obtain required permits from authorities having jurisdiction.
- D. Notify affected utility companies before starting work and comply with their requirements.
- E. Do not close or obstruct roadways, sidewalks, and hydrants, without permits.
- F. Conform to applicable regulatory procedures when discovering hazardous or contaminated materials and contact the Architect and Owner immediately if discovered.
- G. Test soils around buried tanks for contamination.

1.14 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials and using approved contractors so as not to void existing warranties. Notify warrantor before proceeding.
- B. Notify warrantor on completion of selective demolition, and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.
- C. Engage a professional engineer to perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.
 - 1. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.2 CLARIFICATION

- A. The drawings do not purport to show all objects existing on the site.
- B. Before commencing the work of this section, verify with the architect all objects to be removed and all objects to be preserved.

3.3 SCHEDULING

- A. Schedule all work in a careful manner with all necessary consideration for the public and the Owner.
- B. Avoid interference with the use of, and passage to and from, adjacent facilities.

3.4 GENERAL

- A. General: 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.

- B. 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. For Concrete and 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. Proceed with patching after construction operations requiring cutting are complete.
- C. 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.
 - a. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
 - 4. Ceilings: Patch, repair, or rehang 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 weather tight condition.

3.5 PREPARATION

- A. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.6 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished. Refer to engineering drawings for further information.
 - 1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
 - 2. Contractor to arrange to shut off utilities with utility companies.
 - 3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
 - 4. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on drawings to be removed.

- a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
- b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
- c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
- d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
- e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
- f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.

3.7 PROTECTION

- A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
 1. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
 2. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
- B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
 1. Strengthen or add new supports when required during progress of selective demolition.
- C. Remove temporary barricades and protections where hazards no longer exist.
- D. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.8 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
 1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
 2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
 3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
 5. Maintain fire watch during and for at least 24 hours after flame-cutting operations.
 6. Maintain adequate ventilation when using cutting torches.
 7. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.

8. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
 9. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 10. Dispose of demolished items and materials promptly.
- B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

3.9 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least 3/4 inch (19.05 mm) at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.
- B. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, and then remove concrete between saw cuts.
- C. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.
- D. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, and then break up and remove.
- E. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings." Do not use methods requiring solvent-based adhesive strippers.
- F. Roofing: Remove no more existing roofing than what can be covered in one day by new roofing and so that building interior remains watertight and weathertight.
 1. Remove existing roof membrane, flashings, copings, and roof accessories.
 2. Remove existing roofing system down to substrate.

3.10 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.
 1. Do not allow demolished materials to accumulate on-site.
 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
 4. Comply with requirements specified in specification section "Construction Waste Management and Disposal."
- B. Burning: Do not burn demolished materials.

3.11 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION

SECTION 03 10 00 - CONCRETE FLOOR REMOVAL AND REPLACEMENT

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

- A. Provide labor, material, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
 - 1. Concrete removal and replacement.
 - 2. Reinforcement.
 - 3. Accessories.

1.3 REFERENCE STANDARDS

- A. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.
- B. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs; 2017 (Reapproved 2023).
- C. ASTM F1249 - Standard Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor; 2020.
- D. ACI 117 – Standard Tolerances for Concrete Construction and Materials.
- E. ACI 301 – Specifications for Structural Concrete for Buildings.
- F. ACI 302.1R – Guide for Concrete Floor and Slab Construction.
- G. ASTM A615 – Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
- H. ASTM A1064 – Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
- I. ASTM C33 – Standard Specification for Concrete Aggregates.
- J. ASTM C150 – Standard Specification for Portland Cement.

1.4 REFERENCES

- A. Refer to specification Section 014100 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 SUBMITTALS

- A. See Section 013000 – Administrative Requirements and Section 016000 – Product Requirements for submittal procedures.
- B. Product Data: Material descriptions, chemical composition, physical properties, test data, and mixing, preparation, and application instructions.
- C. Qualification Data: For concrete specialist.
- D. Material Certificates: For each type of portland cement and aggregate supplied for mixing or adding to products at Project site.

1.6 QUALITY ASSURANCE

- A. Concrete-Maintenance Specialist Qualifications: Engage an experienced concrete firm that employs installers and supervisors who are trained to perform work of this Section. Firm shall have completed work similar in material, design, and extent to that indicated for this Project with a record of successful in-service performance. Experience in only installing or patching new concrete is insufficient experience for concrete-maintenance work.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Comply with manufacturer's written instructions for minimum and maximum temperature requirements and other conditions for storage.
- B. Store cementitious materials off the ground, under cover, and in a dry location.
- C. Store aggregates covered and in a dry location; maintain grading and other required characteristics and prevent contamination.

1.8 FIELD CONDITIONS

- A. Environmental Limitations for Epoxies: Do not apply when air and substrate temperatures are outside limits permitted by manufacturer. During hot weather, cool epoxy components before mixing, store mixed products in shade, and cool unused mixed products to retard setting. Do not apply to wet substrates unless approved by manufacturer.
- B. Hot-Weather Requirements for Cementitious Materials: Protect repair work when temperature and humidity conditions produce excessive evaporation of water from patching materials. Provide artificial shade and wind breaks, and use cooled materials as required. Do not apply to substrates with temperatures of 90 deg F (32 deg C) and above.

PART 2 PRODUCTS

2.1 CONCRETE, GENERAL

- A. Comply with ACI 301, ACI 302, and ACI 117 (ACI 117M).

2.2 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A615, Grade 60.
- B. Plain-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, plain, fabricated from as-drawn steel wire into flat sheets.

2.3 CONCRETE MATERIALS

- A. Cementitious Materials:
 - 1. Portland Cement: ASTM C 150/C 150M, or Type III.
- B. Normal-Weight Aggregate: ASTM C 33/C 33M, 1/2-inch nominal maximum aggregate size.
- C. Air-Entraining Admixture: ASTM C 260/C 260M.
- D. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
 - 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 - 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
 - 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 - 4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
 - 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
 - 6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
- E. Water: ASTM C 94/C 94M.

2.4 FIBER REINFORCEMENT

- A. Synthetic Micro-Fiber: Monofilament or fibrillated polypropylene micro-fibers engineered and designed for use in concrete, complying with ASTM C 1116/C 1116M, Type III, 1/2 to 1-1/2 inches (38 mm) long.

2.5 CURING MATERIALS

- A. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

2.6 BONDING AGENTS

- A. Epoxy-Modified, Cementitious Bonding and Anticorrosion Agent: Manufactured product that consists of water-insensitive epoxy adhesive, portland cement, and water-based solution of corrosion-inhibiting chemicals that forms a protective film on steel reinforcement.

2.7 SHEET MATERIALS

- A. Below Grade Sheet Retarder shall have the following properties:
 - 1. Basis of Design: "Stego Vapor Barrier" as manufactured by Stego Co.
 - 2. Permeance Rating: Per ASTM E96 or ASTM F1249. Material shall meet permeance requirement for both new material and after ASTM E1745 mandatory condition test sections 8, 11, 12, and 13.
 - 3. Water Vapor Retarder: Meet or exceed Class A per ASTM E1795
 - 4. Polyethylene film, 15-mil thick, and perm rating of .01 perms (gr/ft2/hr/in-HG)
- B. Polyurethane Sealant: ASTM C920, single component, chemical curing, non-sagging, and black color
 - 1. Elongation Capability: 25%
 - 2. Shore A Hardness Range: 20 to 35
- C. Tape shall be as required by the manufacturer of the vapor retarder with a maximum water vapor transmission rate of .03 perms (ASTM E 96).

2.8 CONCRETE MIXTURES

- A. Comply with ACI 301 (ACI 301M).
- B. Normal-Weight Concrete:
 - 1. Minimum Compressive Strength: 4000 psi (27579.04 kPa) at 28 days.
 - 2. Cementitious Materials: Use fly ash, pozzolan, slag cement, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.
 - 3. Slump: 4 inches (101.6 mm) to 5 inches (127 mm) with verified slump of 2 to 4 inches before adding high.
 - 4. Air Content: Maintain within range permitted by ACI 301 (ACI 301M). Do not allow air content of trowel-finished floor slabs to exceed 3 percent.

2.9 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116 and furnish batch ticket information.
 - 1. When air temperature is above 90 degrees Fahrenheit (32.22 degrees Celsius), reduce mixing and delivery time to 60 minutes.

PART 3 EXECUTION

3.1 GENERAL

- A. Have concrete-maintenance work performed only by qualified concrete-maintenance specialist.
- B. Comply with manufacturers' written instructions for surface preparation and product application.

3.2 PREPARATION

- A. Ensure that supervisory personnel are on-site and on duty when work begins and during its progress.
- B. Protect surrounding surfaces of building from harm resulting from work.
 - 1. Comply with each product manufacturer's written instructions for protections and precautions. Protect against adverse effects of products and procedures on people and adjacent materials, components, and vegetation.
 - 2. Use only proven protection methods appropriate to each area and surface being protected.

3. Provide temporary barricades, barriers, and directional signage to exclude public from areas where concrete maintenance work is being performed.
 4. Contain dust and debris generated by concrete maintenance work and prevent it from reaching the public or adjacent surfaces.
 5. Protect adjacent surfaces and equipment by covering them with heavy polyethylene film and waterproof masking tape or a liquid strippable masking agent. If practical, remove items, store, and reinstall after potentially damaging operations are complete.
 6. Dispose of debris and runoff from operations by legal means and in a manner that prevents soil erosion, undermining of paving and foundations, damage to landscaping, and water penetration into building interiors.
- C. Existing Drains: Prior to the start of work in an area, test drainage system to ensure that it is functioning properly. Notify Architect immediately of inadequate drainage or blockage. Do not begin work in an area until the drainage system is in working order.
1. Prevent solids such as aggregate or mortar residue from entering the drainage system. Clean out drains and drain lines that become sluggish or blocked by sand or other materials resulting from concrete maintenance work.
 2. Protect drains from pollutants. Block drains or filter out sediments, allowing only clean water to pass.
- D. Preparation for Concrete Removal: Examine construction to be repaired to determine best methods to safely and effectively perform concrete maintenance work. Examine adjacent work to determine what protective measures will be necessary. Make explorations, probes, and inquiries as necessary to determine condition of construction to be removed in the course of repair.
1. Verify that affected utilities have been disconnected and capped.

3.3 CONCRETE REMOVAL

- A. Saw-cut perimeter of areas indicated for removal to a depth of at least 1/2 inch (12.7 mm). Make cuts perpendicular to concrete surfaces and no deeper than cover on reinforcement.
- B. Thoroughly clean removal areas of loose concrete, dust, and debris.

3.4 BONDING AGENT APPLICATION

- A. Epoxy-Modified, Cementitious Bonding and Anticorrosion Agent: Apply to concrete by stiff brush or hopper spray according to manufacturer's written instructions. Apply to reinforcing bars in two coats, allowing first coat to dry two to three hours before applying second coat. Allow to dry before placing patching mortar or concrete.

3.5 SOIL TREATMENT

- A. Soil Treatment: Treat soil per specification section "Soil Treatment"

3.6 VAPOR BARRIER INSTALLATION

- A. Install, protect, and repair vapor retarders according to ASTM E 1643; place sheets in position with longest dimension parallel with direction of pour.
- B. Remove loose or foreign matter that might impair adhesion.
- C. Clean and prime substrate surfaces to receive adhesive and sealants in accordance with manufacturer's instructions.
- D. Vapor barrier shall be installed in accordance with manufacturer's specifications, free of air pockets and wrinkles.
- E. All laps shall be continuously sealed with adhesive according to manufacturer's recommendations.
- F. Lap all joints a minimum of 6" and tape joints.
- G. Seal all penetrations (including pipes) per manufacturer's requirements with tape to restore barrier integrity.

- H. Secure to existing vapor barrier at least 6" where possible. If not possible provide 2" tape lap under existing vapor barrier and tie in new vapor barrier and provide additional tape to provide a tight seal.

3.7 REINFORCEMENT INSTALLATION

- A. Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
 - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Install #5 rebar dowels 12" long at 24" o.c. around perimeter of opening. Drill 6" deep hole in existing concrete and secure with non-shrink grout.
- C. Install welded wire fabric and lap adjoining pieces at least one full mesh and lace splices with 16-gauge wire.

3.8 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness, as follows:
- C. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
 - 1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.

3.9 CONCRETE PLACEMENT

- A. Comply with ACI 301 for placing concrete.
- B. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
- C. Do not add water to concrete during delivery, at Project site, or during placement.
- D. Consolidate concrete with mechanical vibrating equipment according to ACI 301.

3.10 FINISHING UNFORMED SURFACES

- A. General: Comply with ACI 302.1R for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Screed surfaces with a straightedge and strike off. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane before excess moisture or bleedwater appears on surface.
 - 1. Do not further disturb surfaces before starting finishing operations.
- C. Finish: Match adjacent existing floor finishes unless otherwise indicated.

3.11 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with ACI 301 (ACI 301M) for hot-weather protection during curing.
- B. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- C. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours

later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.12 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Tests: Perform according to ACI 301 (ACI 301M).
 - 1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
 - 2. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.

END OF SECTION

SECTION 03 35 00 - CONCRETE FLOOR FINISHING (SEALER)

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

- A. Provide labor, materials, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
 - 1. Floor sealer.

1.3 REFERENCE STANDARDS

- A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; Current Edition.

1.4 REFERENCES

- A. Refer to specification Section 01 41 00 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 SUBMITTALS

- A. See Section 01 30 00 – Administrative Requirements and Section 01 60 00 – Product Requirements for submittal procedures.
- B. Provide data on concrete sealer, and slip resistant treatment, compatibilities, and limitations.
- C. Maintenance Data: Provide data on maintenance renewal of applied coatings.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in manufacturer's packaging including application instructions.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Temporary Lighting: Provide minimum 200 W light source, 8' above the floor surface, for each 425 sq. ft. of floor being finished.
- B. Temporary Heat: Ambient temperature of 50° F (10° C) minimum
- C. Ventilation: Sufficient to prevent injurious gases from temporary heat or other sources affecting concrete.

1.8 FIELD CONDITION

- A. Coordinate the work with concrete floor placement and concrete floor curing.

PART 2 – PRODUCTS

2.1 CLEAR FLOOR SEALER

- A. Polyamide epoxy sealer.
 - 1. Color: Clear.
 - 2. Texture: Smooth.

2.2 ENVIRONMENTAL

- A. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
- B. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - 1. Plastic Foam Adhesives: 50 g/L.
 - 2. Gypsum Board and Panel Adhesives: 50 g/L.

3. Multipurpose Construction Adhesives: 70 g/L.
4. Fiberglass Adhesives: 80 g/L.
5. Contact Adhesive: 80 g/L.
6. Other Adhesives: 250 g/L.
7. Single-Ply Roof Membrane Sealants: 450 g/L.
8. Nonmembrane Roof Sealants: 300 g/L.
9. Sealant Primers for Nonporous Substrates: 250 g/L.
10. Sealant Primers for Porous Substrates: 775 g/L.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Verify that floor surfaces are acceptable to receive the work of this section.

3.2 GENERAL FINISHING

- A. See Drawings for locations and type of specialized floor finish and treatment in accordance with design intent. Contractor to coordinate with Architect for all field samples and installations.

3.3 FLOOR SURFACE TREATMENT INSTALLATION

- A. Apply sealer in accordance with the manufacturer's instructions as scheduled.

END OF SECTION

SECTION 04 01 00 - MAINTENANCE OF MASONRY (BEAM)

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Water cleaning of masonry surfaces.
- B. Repointing mortar joints.

1.2 RELATED REQUIREMENTS

- A. Section 04 20 00 - Unit Masonry: Brick masonry units.

1.3 REFERENCE STANDARDS

- A. ACI SPEC-548.14 - Specification for Repairing Concrete with Epoxy Mortar; 2014.
- B. ASTM C881/C881M - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete; 2020a.
- C. ASTM D3039/D3039M - Standard Test Method for Tensile Properties of Polymer Matrix Composite Materials; 2017.
- D. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2022, with Errata (2024).

1.4 REFERENCES

- A. Refer to specification Section 014100 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene one week prior to commencing work of this section.
 - 1. Require attendance of parties directly affecting work of this section.
 - 2. Review conditions of installation, installation procedures, and coordination with related work.

1.6 ACTION SUBMITTALS

- A. See Section 013000 – Administrative Requirements and Section 016000 – Product Requirements for submittal procedures.
- B. Product Data: Provide data on cleaning compounds.
- C. Product Data: For masonry materials to be used for tuckpointing.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver masonry neatly stacked and tied on pallets. Store clear of ground with adequate waterproof covering.

1.8 FIELD CONDITIONS - MASONRY WORK

- A. Cold and Hot Weather Requirements: Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.
- B. Maintain materials and surrounding air temperature to minimum 40 degrees F (5 degrees C) prior to, during, and 48 hours after completion of masonry work.
- C. Maintain materials and surrounding air temperature to maximum 90 degrees F (32 degrees C) prior to, during, and 48 hours after completion of masonry work.

1.9 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Warranty: Provide 5-year warranty for CFRP system design, installation, bond to the substrate, and interlaminar bond, as well as mechanical property retention and fabric-resin compatibility, commencing on Date of Substantial Completion. Complete forms in Town of Canton's name and register with warrantor.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Restoration and Cleaning Chemicals:
 - 1. Diedrich Technologies, Inc: www.diedrichtechnologies.com/#sle.
 - 2. HMK Stone Care System: www.hmkstonecare.com/#sle.
 - 3. PROSOCO: www.prosoco.com/#sle.
 - 4. Substitutions: See Section 01 60 00 - Product Requirements.

2.2 CLEANING MATERIALS

- A. Cleaning Agent: Detergent type.

2.3 MORTAR MATERIALS

2.4 MASONRY MATERIALS

- A. Block: Section 04 20 00.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that surfaces to be cleaned are ready for work of this section.

3.2 PREPARATION

- A. Protect surrounding elements from damage due to restoration procedures.
- B. Carefully remove and store removable items located in areas to be restored, including fixtures, fittings, finish hardware, and accessories; reinstall upon completion.
- C. Separate areas to be protected from restoration areas using means adequate to prevent damage.
- D. Mask immediately adjacent surfaces with material that will withstand cleaning and restoration procedures.
- E. Protect roof membrane and flashings from damage with 1/2 inch (13 mm) plywood laid on roof surfaces over full extent of work area and traffic route.

3.3 INSTALLATION - RETROFIT ACCESSORIES

- A. Install in accordance with manufacturer's written instructions.

3.4 REPOINTING

- A. Perform repointing prior to cleaning masonry surfaces.
- B. Cut out loose or disintegrated mortar in joints to minimum 1/2 inch (6 mm) depth or until sound mortar is reached.
- C. Use power tools only after test cuts determine no damage to masonry units will result.
- D. Do not damage masonry units.
- E. When cutting is complete, remove dust and loose material by brushing.
- F. Premoisten joint and apply mortar. Pack tightly in maximum 1/4 inch (6 mm) layers. Form a smooth, compact concave joint to match existing.
- G. Moist cure for 72 hours.

3.5 CLEANING EXISTING MASONRY

- A. Cleaning Detergent: Brush clean masonry surfaces at where indicated locations with cleaning agent in accordance with the manufacturer's instructions. Saturate masonry with clean water and flush loose mortar and dirt.

3.6 CLEANING

- A. Immediately remove stains, efflorescence, or other excess resulting from the work of this section.

- B. Remove excess mortar, smears, and droppings as work proceeds and upon completion.
- C. Clean surrounding surfaces.

END OF SECTION

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SECTION 04 10 22 - MASONRY INFILL

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

- A. Provide labor, material, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
 - 1. Repairing voids in masonry.

1.3 REFERENCE STANDARDS

- A. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire; 2019 (Reapproved 2025).
- B. ASTM A951/A951M - Standard Specification for Steel Wire for Masonry Joint Reinforcement; 2022.
- C. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2022.
- D. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units; 2023.
- E. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2018.
- F. ASTM C1329/C1329M - Standard Specification for Mortar Cement; current edition.
- G. ASTM C150 - Standard Specification for Portland Cement.
- H. ASTM C270 Standard Specifications for Mortar for Unit Masonry.

1.4 REFERENCES

- A. Refer to specification Section 014100 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 ACTION SUBMITTALS

- A. See Section 013000 - Administrative Requirements and Section 016000 - Product Requirements for submittal procedures.
- B. Product Data: For each type of product.
 - 1. Include recommendations for product application and use. Include test data substantiating that products comply with requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver packaged materials to Project site in manufacturer's original and unopened containers, labeled with manufacturer's name and type of products.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

1.7 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit brick masonry repair work to be performed according to product manufacturers' written instructions and specified requirements.

PART 2 PRODUCTS

2.1 MASONRY MATERIALS

- A. Shapes: Provide shapes with exposed surfaces matching existing exposed faces of adjacent units.
- B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed work and will be within 20 feet (609.6 cm) vertically and horizontally of a walking surface.
- C. CMUs: ASTM C90.
 - 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2150 psi (14823.73 kPa).
 - 2. Density Classification: light weight (105 PCF max.)
 - 3. Size and Shape: Match existing.
 - 4. Exposed Faces: Provide texture matching existing.

2.2 MORTAR MATERIALS

- A. Mortar Cement: ASTM C1329/C1329M.
- B. Mortar Sand: ASTM C144.
 - 1. Exposed Mortar: Match size, texture, and gradation of existing mortar sand as closely as possible. Blend several sands if necessary to achieve suitable match.
- C. Water: Potable.

2.3 REINFORCEMENT

- A. Masonry-Joint Reinforcement, General: Ladder type complying with ASTM A951/A951M.
- B. Mill-Galvanized, Carbon-Steel Wire: ASTM A 1064/A 81064M, with ASTM A641/A641M, Class 1 coating.
- C. Corrugated-Metal Ties: Metal strips not less than 7/8 inch (22.22 mm) wide with corrugations having a wavelength of 0.3 to 0.5 inch (12.7 mm) and an amplitude of 0.06 to 0.10 inch (2.54 mm) made from 0.075-inch thick steel sheet, galvanized after fabrication.
- D. Uncoated Steel Re-inforcing Bars: ASTM A615/A615M or ASTM A996/A996M, Grade 60.

2.4 MORTAR MIXES

- A. Measurement and Mixing: Measure cementitious materials and sand in a dry condition by volume or equivalent weight. Do not measure by shovel; use known measure. Mix materials in a clean, mechanical batch mixer.
- B. Do not use admixtures in mortar unless otherwise indicated.

PART 3 EXECUTION

3.1 MASONRY REPAIR, GENERAL

- A. Appearance Standard: Repaired surfaces are to have a uniform appearance as viewed from 20 feet (609.6 cm) away by Architect.

3.2 MASONRY INSTALLATION GENERAL

- A. Install masonry into bonding and coursing patterns. If cutting is required, use a motor-driven saw designed to cut masonry with clean, sharp, unchipped edges.
 - 1. Use setting buttons or shims to set units accurately spaced with uniform joints.
- B. Lay masonry with rebuilding (setting) mortar and with completely filled bed, head, and collar joints. Butter ends with enough mortar to fill head joints and shove into place. Wet both replacement and surrounding masonry.
 - 1. Tool exposed mortar joints in infill areas flush.

3.3 MASONRY-JOINT REINFORCEMENT

- A. General: Install horizontal reinforcing the entire length in mortar with a minimum cover of 5/8 inch (15.88 mm) on exterior side of walls and lap reinforcement a minimum of 6 inches (152.4 mm). Space reinforcement not more than 16 inches (406.4 mm) o.c.
- B. Install metal ties where horizontal reinforcing meets vertical wall surface of opening.

3.4 MASONRY INSTALLATION

- A. Rinse surface to be infilled and leave damp, but without standing water.
- B. Brush-coat surfaces with slurry coat of mortar compound.
- C. Place mortar compound in layers, but not less than 1/4 inch (6.35 mm) or more than 2 inches (50.8 mm) thick. Roughen surface of each layer to provide a key for next layer.
- D. Trowel, scrape, or carve surface of infill areas flush with surrounding surface plane. Shape and finish surface before or after curing, as determined by testing.
- E. Keep each layer damp for 72 hours or until patching compound has set.

3.5 FINAL CLEANING

- A. After mortar has fully hardened, thoroughly clean exposed masonry surfaces of excess mortar and foreign matter; use wood scrapers, stiff-nylon or -fiber brushes, and clean water applied by low-pressure spray.
 - 1. Do not use metal scrapes or brushes.
 - 2. Do not use acidic or alkaline cleaners.
- B. Clean adjacent non-masonry surfaces. Use detergent and soft brushes or cloths.
- C. Clean mortar and debris from roof; remove debris from gutters and downspouts. Rinse off roof and flush gutters and downspouts.
- D. Remove masking materials, leaving no residues that could trap dirt.

END OF SECTION

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SECTION 04 10 24 - MASONRY REPAIR

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

- A. Provide labor, material, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
 - 1. Repairing voids in masonry.

1.3 REFERENCE STANDARDS

- A. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units; 2023.
- B. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2018.
- C. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2018.
- D. ASTM C1329/C1329M - Standard Specification for Mortar Cement; current edition.
- E. ASTM C1392/C1392M – Standard Specification for Mortar Cement.

1.4 REFERENCES:

- A. Refer to specification Section 01 41 00 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 ACTION SUBMITTALS

- A. See Section 01 30 00 – Administrative Requirements and Section 01 60 00 – Product Requirements for submittal procedures.
- B. Product Data: For each type of product.
 - 1. Include recommendations for product application and use. Include test data substantiating that products comply with requirements.

1.6 QUALITY ASSURANCE

- A. Mockups: Prepare mockups of masonry repair to demonstrate aesthetic effects and to set quality standards for materials and execution and for fabrication and installation.
 - 1. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver packaged materials to Project site in manufacturer's original and unopened containers, labeled with manufacturer's name and type of products.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

1.8 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit masonry repair work to be performed according to product manufacturers' written instructions and specified requirements.

PART 2 PRODUCTS

2.1 MASONRY MATERIALS

- A. Shapes: Provide shapes with exposed surfaces matching existing exposed faces of adjacent units.

- B. CMUs: ASTM C90.
 - 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2150 psi (14823.73 kPa).
 - 2. Density Classification: Normal weight.
 - 3. Size and Shape: Match existing.
 - 4. Exposed Faces: Provide texture matching existing.

2.2 MORTAR MATERIALS

- A. Mortar Cement: ASTM C1329/C1329M.
- B. Mortar Sand: ASTM C144.
 - 1. Exposed Mortar: Match size, texture, and gradation of existing mortar sand as closely as possible. Blend several sands if necessary to achieve suitable match.
- C. Water: Potable.

2.3 MORTAR MIXES

- A. Measurement and Mixing: Measure cementitious materials and sand in a dry condition by volume or equivalent weight. Do not measure by shovel; use known measure. Mix materials in a clean, mechanical batch mixer.
- B. Do not use admixtures in mortar unless otherwise indicated.

PART 3 EXECUTION

3.1 MASONRY REPAIR, GENERAL

- A. Appearance Standard: Repaired surfaces are to have a uniform appearance as viewed from 20 feet (609.6 cm) away by Architect.

3.2 MASONRY INSTALLATION REPLACEMENT

- A. Install masonry into bonding and coursing pattern of existing masonry. If cutting is required, use a motor-driven saw designed to cut masonry with clean, sharp, unchipped edges.
 - 1. Maintain joint width for replacement units to match existing joints.
 - 2. Use setting buttons or shims to set units accurately spaced with uniform joints.
- B. Lay replacement masonry with rebuilding (setting) mortar and with completely filled bed, head, and collar joints. Butter ends with enough mortar to fill head joints and shove into place. Wet both replacement and surrounding masonry.
 - 1. Tool exposed mortar joints in repaired areas to match joints of surrounding existing masonry.

3.3 MASONRY UNIT PATCHING

- A. Patch the following masonry units:
 - 1. Patch masonry units with voids and holes.
 - 2. Remove loose material from masonry surface. Carefully remove additional material so patch does not have feathered edges but has square or slightly undercut edges on area to be patched and is at least 1/4 inch (6.35 mm) thick, but not less than recommended by patching compound manufacturer.
 - 3. Rinse surface to be patched and leave damp, but without standing water.
 - 4. Brush-coat surfaces with slurry coat of mortar compound.
 - 5. Place mortar compound in layers, but not less than 1/4 inch (6.35 mm) or more than 2 inches (50.8 mm) thick. Roughen surface of each layer to provide a key for next layer.
 - 6. Trowel, scrape, or carve surface of patch to match texture and surrounding surface plane of masonry unit. Shape and finish surface before or after curing, as determined by testing, to best match existing masonry unit.
 - 7. Keep each layer damp for 72 hours or until patching compound has set.

3.4 FINAL CLEANING

- A. After mortar has fully hardened, thoroughly clean exposed masonry surfaces of excess mortar and foreign matter; use wood scrapers, stiff-nylon or -fiber brushes, and clean water applied by low-pressure spray.
 - 1. Do not use metal scrapers or brushes.
 - 2. Do not use acidic or alkaline cleaners.
- B. Clean adjacent non-masonry surfaces. Use detergent and soft brushes or cloths.
- C. Clean mortar and debris from roof; remove debris from gutters and downspouts. Rinse off roof and flush gutters and downspouts.
- D. Remove masking materials, leaving no residues that could trap dirt.

END OF SECTION

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SECTION 04 20 00 - UNIT MASONRY

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 SECTION INCLUDES:

- A. Concrete block.
- B. Mortar and grout.
- C. Reinforcement and anchorage.
- D. Accessories.

1.3 REFERENCE STANDARDS

- A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
- B. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire; 2019 (Reapproved 2025).
- C. ASTM A951/A951M - Standard Specification for Steel Wire for Masonry Joint Reinforcement; 2022.
- D. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2022.
- E. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units; 2023.
- F. ASTM C129 - Standard Specification for Nonloadbearing Concrete Masonry Units; 2023.
- G. ASTM C140/C140M - Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units; 2023a.
- H. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2019a, with Editorial Revision.
- I. ASTM C744 - Standard Specification for Prefaced Concrete and Calcium Silicate Masonry Units; 2021.
- J. ASTM C780 - Standard Test Methods for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry; 2023.
- K. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2022, with Errata (2024).

1.4 REFERENCES:

- A. Refer to specification Section 014100 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 ACTION SUBMITTALS

- A. Refer to Section 01 33 00 - Submittal Procedures for submittal procedures.
- B. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, and masonry accessories.
- C. Shop Drawings: Indicate pertinent dimensions, materials, anchorage, size and type of fasteners, and accessories for support system.
 - 1. Include calculations or selections from the manufacturer's prescriptive design tables that indicate compliance with the applicable building code and project conditions.
 - 2. Include the design engineer's stamp or seal on each sheet of shop drawings.

- D. Samples: Submit four samples of decorative block units to illustrate color, texture, and extremes of color range.
- E. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.
- F. Test Reports: Concrete masonry manufacturer's test reports for units with integral water repellent admixture.
- G. Designer's Qualification Statement.
- H. Manufacturer's Qualification Statement.
- I. Installer's Qualification Statement.
- J. Maintenance Materials: Furnish the following for Town of Canton's use in maintenance of project.
 - 1. Refer to Section 01 60 00 - Product Requirements, for additional provisions.

1.6 QUALITY ASSURANCE

- A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.
 - 1. Maintain one copy of each document on project site.
- B. Designer Qualifications: Perform design under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.
- C. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section with minimum three years of documented experience.
- D. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.
- B. Handle and store unit masonry in protective cartons or trays. Do not remove from protective packaging until ready for installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers.
 - 1. Concrete Masonry Units:
 - a. ACME Block & Brick: www.acmeblockandbrick.com.
 - b. Best Block: www.bestblock.com.
 - c. Boral Industries Company:
 - d. Concrete Products Group (The): www.concreteproductsgroup.com.
 - e. Omni Block, Inc.: www.omniblock.com.
 - f. Revels Block & Brick Company.
 - g. Texas Building Products, Inc.
 - 2. Mortar:
 - a. QUIKRETE Companies (The): www.quikrete.com.
 - 3. Masonry Support Systems:
 - a. Hohmann & Barnard, Inc; www.h-b.com.
- B. Substitutions: Refer to Section 01 25 13.0 - Substitution Procedures.
 - 1. Substitutions.

2.2 CONCRETE MASONRY UNITS

- A. Concrete Block: Comply with referenced standards and as follows:
 - 1. Size: Standard units with nominal face dimensions of 16 by 8 inches (400 by 200 mm) and nominal depth as indicated on Drawings.

2. Load-Bearing Units: ASTM C90, lightweight.
 - a. Both hollow and solid block, as indicated.
 - b. Exposed Faces: Manufacturer's full range of colors and textures where indicated.
 - c. Pattern: Vertical single score.
3. Non-Loadbearing Units: ASTM C129.
 - a. Hollow block, as indicated.
 - b. Lightweight.
4. Pre-Faced Units: ASTM C90, hollow block, with smooth resinous facing complying with ASTM C744.
 - a. Colors and styles: As indicated on drawings.
5. Standard Units with Factory-Installed Insulation Inserts: ASTM C90, lightweight.
 - a. Size: Standard units with nominal face dimensions of 16 by 8 inches (400 by 200 mm) and nominal depth of 8 inches (200 mm).
 - b. Insulation Type: Manufacturer's standard expanded polystyrene (XPS).
 - c. Pattern: Vertical single score.
 - d. Exposed Faces: Color and texture to be selected from manufacturer's standard range.

2.3 MORTAR AND GROUT MATERIALS

- A. Mortar and Grout: As specified in Section 04 05 00.

2.4 REINFORCEMENT AND ANCHORAGE

- A. Manufacturers:
1. Blok-Lok Limited: www.blok-lok.com.
 2. X-Seal Anchor manufactured by Hohmann & Barnard, Inc: www.h-b.com.
 3. WIRE-BOND www.wirebond.com.
 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Reinforcing Steel: Uncoated Steel Reinforcing Bars: ASTYM A65/A615M or ASTM A996/A996M, Grade 60.
- C. Joint Reinforcement: Use ladder type joint reinforcement where vertical reinforcement is involved and truss type elsewhere, unless otherwise indicated.
- D. Single Wythe Joint Reinforcement: ASTM A951/A951M.
1. Type: Truss or ladder.
 2. Material: ASTM A1064/A1064M steel wire, mill galvanized to ASTM A641/A641M Class 3.
 3. Size: 0.1483 inch (3.8 mm) side rods with 0.1483 inch (3.8 mm) cross rods; width as required to provide not less than 5/8 inch (16 mm) of mortar coverage on each exposure.
- E. Strap Anchors: Bent steel shapes, 1-1/2 inch (38 mm) width, 0.105 inch (2.7 mm) thick, 24 inch (610 mm) length, with 1-1/2 inch (38 mm) long, 90 degree bend at each end to form a U or Z shape or with cross pins, hot dip galvanized to ASTM A153/A153M Class B.
- F. Flexible Anchors: 2-piece anchors that permit differential movement between masonry and building frame, sized to provide not less than 5/8 inch (16 mm) of mortar coverage from masonry face.
1. Concrete frame: Dovetail anchors of bent steel strap, nominal 1 inch (25 mm) width x 0.024 in (0.61 mm) thick, with trapezoidal wire ties 0.1875 inch (4.75 mm) thick, hot dip galvanized to ASTM A 153/A 153M, Class B.
 2. Steel frame: Crimped wire anchors for welding to frame, 0.25 inch (6.3 mm) thick, with trapezoidal wire ties 0.1875 inch (4.75 mm) thick, hot dip galvanized to ASTM A 153/A 153M, Class B.
- G. Two-Piece Wall Ties: Formed steel wire, 0.1875 inch (4.8 mm) thick, adjustable, eye and pintle type, hot dip galvanized to ASTM A 153/A 153M, Class B, sized to provide not less than 5/8 inch (16 mm) of mortar coverage from masonry face and to allow vertical adjustment of up to 1-1/4 in (32 mm).

- H. Masonry Veneer Anchors: 2-piece anchors that permit differential movement between masonry veneer and structural backup, hot dip galvanized to ASTM A 153/A 153M, Class B.
 - 1. Anchor plates: Not less than 0.075 inch (1.91 mm) thick, designed for fastening to structural backup through sheathing by two fasteners; provide design with legs that penetrate sheathing and insulation to provide positive anchorage.
 - 2. Wire ties: Manufacturer's standard shape, 0.1875 inch (4.75 mm) thick.
 - 3. Vertical adjustment: Not less than 3-1/2 inches (89 mm).
- I. Metal-to-Metal Fasteners: Self-drilling, self-tapping screws; corrosion resistant finish or hot dip galvanized to ASTM A153/A153M.
 - 1. Manufacturers:
 - a. ITW Commercial Construction North America; Teks Select Series: www.ITWBuildex.com.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.

2.5 ACCESSORIES

- A. Preformed Control Joints: Rubber material. Provide with corner and tee accessories, fused joints.
 - 1. Manufacturers:
 - a. Blok-Lok Limited: www.blok-lok.com.
 - b. Hohmann & Barnard, Inc: www.h-b.com.
 - c. WIRE-BOND: www.wirebond.com.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Joint Filler: Closed cell polyvinyl chloride; oversized 50 percent to joint width; self expanding; in maximum lengths available.
 - 1. Manufacturers:
 - a. Hohmann & Barnard, Inc: www.h-b.com.
 - b. WIRE-BOND: www.wirebond.com.
 - c. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

2.6 LINTELS

- A. Prefabricated Steel Lintels:
 - 1. Basis of Design:
 - a. Engineered Concealed Lintel Systems manufactured by Hohmann & Barnard, Inc.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive masonry.
- B. Verify that related items provided under other sections are properly sized and located.
- C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.2 PREPARATION

- A. Direct and coordinate placement of metal anchors supplied for installation under other sections.
- B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.3 COLD AND HOT WEATHER REQUIREMENTS

- A. Maintain materials and surrounding air temperature to minimum 40 degrees F (5 degrees C) prior to, during, and 48 hours after completion of masonry work.
- B. Maintain materials and surrounding air temperature to maximum 90 degrees F (32 degrees C) prior to, during, and 48 hours after completion of masonry work.

3.4 COURSING

- A. Establish lines, levels, and coursing indicated. Protect from displacement.
- B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
- C. Concrete Masonry Units:
 - 1. Bond: As indicated on Drawings.
 - 2. Coursing: One unit and one mortar joint to equal 8 inches (200 mm).
 - 3. Mortar Joints: Concave.

3.5 PLACING AND BONDING

- A. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.
- B. Remove excess mortar and mortar smears as work progresses.
- C. Remove excess mortar with water repellent admixture promptly. Do not use acids, sandblasting or high pressure cleaning methods.
- D. Interlock intersections and external corners, except for units laid in stack bond.
- E. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
- F. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
- G. Cut mortar joints flush where wall tile is scheduled or resilient base is scheduled.
- H. Isolate masonry partitions from vertical structural framing members with a control joint as indicated.
- I. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.

3.6 REINFORCEMENT AND ANCHORAGE - GENERAL AND CAVITY WALL MASONRY

- A. Unless otherwise indicated on drawings or specified under specific wall type, install horizontal joint reinforcement 16 inches (400 mm) on center.
- B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches (400 mm) each side of opening.
- C. Place continuous joint reinforcement in first and second joint below top of walls.
- D. Embed longitudinal wires of joint reinforcement in mortar joint with at least 5/8 inch (16 mm) mortar cover on each side.
- E. Lap joint reinforcement ends minimum 6 inches (150 mm).
- F. Reinforce stack bonded unit joint corners and intersections with strap anchors 16 inches (400 mm) on center.
- G. Fasten anchors to structural framing and embed in masonry joints as masonry is laid. Unless otherwise indicated on drawings or closer spacing is indicated under specific wall type, space anchors at maximum of 36 inches (900 mm) horizontally and 24 inches (600 mm) vertically.
- H. Embed ties and anchors in mortar joint and extend into masonry unit a minimum of 1-1/2 inches (38 mm) with at least 5/8 inch (16 mm) mortar cover to the outside face of the anchor.

3.7 LINTELS

- A. Install loose steel lintels over openings.
- B. Install reinforced unit masonry lintels over openings where steel or precast concrete lintels are not scheduled.
 - 1. Openings to 42 inches (1070 mm): Place two, No. 3 (M9) reinforcing bars 1 inch (25 mm) from bottom web.
 - 2. Do not splice reinforcing bars.

3. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch (13 mm) of dimensioned position.
 4. Place and consolidate grout fill without displacing reinforcing.
 5. Allow masonry lintels to attain specified strength before removing temporary supports.
- C. Maintain minimum 8-inch bearing on each side of opening.

3.8 GROUTED COMPONENTS

- A. Lap splices minimum 24 bar diameters.
- B. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch (13 mm) of dimensioned position.
- C. Place and consolidate grout fill without displacing reinforcing.
- D. At bearing locations, fill masonry cores with grout for a minimum 12 inches (300 mm) either side of opening.

3.9 CONTROL AND EXPANSION JOINTS

- A. Do not continue horizontal joint reinforcement through control or expansion joints.
- B. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.
- C. Size control joints as indicated on drawings; if not indicated, 3/4 inch (19 mm) wide and deep.

3.10 BUILT-IN WORK

- A. As work progresses, install built-in metal door frames and glazed frames and other items to be built into the work and furnished under other sections.
- B. Install built-in items plumb, level, and true to line.
- C. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout.
1. Fill adjacent masonry cores with grout minimum 12 inches (300 mm) from framed openings.
- D. Do not build into masonry construction organic materials that are subject to deterioration.

3.11 TOLERANCES

- A. Install masonry within the site tolerances found in TMS 402/602.
- B. Maximum Variation from Alignment of Columns: 1/4 inch (6 mm).
- C. Maximum Variation From Unit to Adjacent Unit: 1/16 inch (1.6 mm).
- D. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft (6 mm/3 m) and 1/2 inch in 20 ft (13 mm/6 m) or more.
- E. Maximum Variation from Plumb: 1/4 inch (6 mm) per story non-cumulative; 1/2 inch (13 mm) in two stories or more.
- F. Maximum Variation from Level Coursing: 1/8 inch in 3 ft (3 mm/m) and 1/4 inch in 10 ft (6 mm/3 m); 1/2 inch in 30 ft (13 mm/9 m).
- G. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch (minus 6.4 mm, plus 9.5 mm).
- H. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch (6 mm).

3.12 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00 - Quality Requirements.
- B. Concrete Masonry Unit Tests: Test each variety of concrete unit masonry in accordance with ASTM C140/C140M for compliance with requirements of this specification.

- C. Mortar Tests: Test each type of mortar in accordance with ASTM C780, testing with same frequency as masonry samples.

3.13 CLEANING

- A. Remove excess mortar and mortar droppings.
- B. Replace defective mortar. Match adjacent work.
- C. Clean soiled surfaces with cleaning solution.
- D. Use non-metallic tools in cleaning operations.

3.14 PROTECTION

- A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

END OF SECTION

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SECTION 05 12 00 - STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.1 SUMMARY

- A. Structural-steel materials.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

- A. Product Data:
 - 1. Structural-steel materials.
 - 2. Shrinkage-resistant grout.
- B. Shop Drawings: Show fabrication of structural-steel components.
 - 1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
 - 2. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
 - 3. Indicate type, size, and length of bolts, distinguishing between shop and field bolts.
 - 4. Identify members not to be shop primed.
- C. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide in accordance with AWS D1.1/D1.1M for each welded joint whether prequalified or qualified by testing, including the following:
 - 1. Power source (constant current or constant voltage).
 - 2. Electrode manufacturer and trade name, for demand-critical welds.
- D. Delegated Design Submittal: For structural-steel connections indicated on Drawings to comply with design loads, include analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For fabricator.
- B. Welding certificates.
- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- D. Mill test reports for structural-steel materials, including chemical and physical properties.
- E. Product Test Reports: For the following:
 - 1. Bolts, nuts, and washers, including mechanical properties and chemical analysis.
- F. Survey of existing conditions.
- G. Source quality-control reports.
- H. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU or is accredited by the IAS Fabricator Inspection Program for Structural Steel (Acceptance Criteria 172).
- B. Installer Qualifications: A qualified Installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category ACSE.
- C. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M.

1. Welders and welding operators performing work on bottom-flange, demand-critical welds are to pass the supplemental welder qualification testing, as required by AWS D1.8/D1.8M. FCAW-S and FCAW-G are to be considered separate processes for welding personnel qualification.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Comply with applicable provisions of the following specifications and documents:
 1. ANSI/AISC 303.
 2. ANSI/AISC 341.
 3. ANSI/AISC 360.
 4. RCSC's "Specification for Structural Joints Using High-Strength Bolts."
- B. Connection Design Information:
 1. Option 3 and 3A: Design connections in accordance with ANSI/AISC 303 by fabricator's qualified professional engineer. Member reinforcement at connections is indicated on Drawings.
 - a. Use Allowable Stress Design; data are given at service-load level.

2.2 STRUCTURAL-STEEL MATERIALS

- A. W-Shapes: ASTM A992/A992M.
- B. Channels, M-Shapes: ASTM 992.
- C. Angles: ASTM A36/A36M.
- D. Plate and Bar: ASTM A36/A36M.
- E. Cold-Formed Hollow Structural Sections: ASTM A500/A500M, Grade C structural tubing.
- F. Welding Electrodes: Comply with AWS requirements.

2.3 BOLTS AND CONNECTORS

- A. High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers; all with plain finish.
 1. Direct-Tension Indicators: ASTM F959/F959M, Type 325-1, compressible-washer type with plain finish.

2.4 RODS

- A. Threaded Rods: ASTM A36/A36M.
 1. Nuts: ASTM A63 heavy-hex carbon steel.
 2. Washers: ASTM A36/A36M carbon steel.
 3. Finish: Hot-dip zinc coating, ASTM A153/A153M, Class C.

2.5 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate in accordance with ANSI/AISC 303 and to ANSI/AISC 360.
 1. Fabricate beams with rolling camber up.
 2. Identify high-strength structural steel in accordance with ASTM A6/A6M and maintain markings until structural-steel framing has been erected.
 3. Mark and match-mark materials for field assembly.
 4. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
 1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.
- C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.

- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted in accordance with SSPC-SP 2.
- F. Steel Wall-Opening Framing: Select true and straight members for fabricating steel wall-opening framing to be attached to structural-steel frame. Straighten as required to provide uniform, square, and true members in completed wall framing. Build up welded framing, weld exposed joints continuously, and grind smooth.
- G. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.
 - 1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
 - 2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
 - 3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.6 SOURCE QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform shop tests and inspections.
 - 1. Allow testing agency access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
 - 2. Bolted Connections: Inspect and test shop-bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
 - 3. Welded Connections: Visually inspect shop-welded connections in accordance with AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
 - a. Liquid Penetrant Inspection: ASTM E165/E165M.
 - b. Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
 - c. Ultrasonic Inspection: ASTM E164.
 - d. Radiographic Inspection: ASTM E94/E94M.
 - 4. In addition to visual inspection, test and inspect shop-welded shear stud connectors in accordance with requirements in AWS D1.1/D1.1M for stud welding and as follows:
 - a. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear stud connector.
 - b. Conduct tests in accordance with requirements in AWS D1.1/D1.1M on additional shear stud connectors if weld fracture occurs on shear stud connectors already tested.
 - 5. Prepare test and inspection reports.

PART 3 EXECUTION

3.1 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and in accordance with ANSI/AISC 303 and ANSI/AISC 360.
- B. Maintain erection tolerances of structural steel within ANSI/AISC 303.
- C. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 - 1. Level and plumb individual members of structure. Slope roof framing members to slopes indicated on Drawings.
 - 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- D. Splice members only where indicated.

- E. Do not use thermal cutting during erection.
- F. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

3.2 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector to perform the following special inspections:
 - 1. Verify structural-steel materials and inspect steel frame joint details.
 - 2. Verify weld materials and inspect welds.
 - 3. Verify connection materials and inspect high-strength bolted connections.
- B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
 - 1. Bolted Connections: Inspect and test bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
 - 2. Welded Connections: Visually inspect field welds in accordance with AWS D1.1/D1.1M.
 - a. In addition to visual inspection, test and inspect field welds in accordance with AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
 - 1) Liquid Penetrant Inspection: ASTM E165/E165M.
 - 2) Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
 - 3) Ultrasonic Inspection: ASTM E164.
 - 4) Radiographic Inspection: ASTM E94/E94M.

END OF SECTION

SECTION 05 50 00 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES:

- A. Provide labor, material, services and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to the following metal fabrications:
 - 1. Miscellaneous Metal Fabrications.
 - a. Rough hardware.
 - 2. Miscellaneous Framing and Supports:
 - a. Countertop Supports.
 - 3. Metal Ladders.
 - a. Steel ladders.
 - 4. Miscellaneous Steel Trim.
 - 5. Miscellaneous Aluminum Trim.

1.3 REFERENCE STANDARDS

- A. ANSI A14.3 – American National Standard for Ladders - Fixed - Safety Requirements.
- B. ASTM A283 – Carbon Steel Plates, Shapes, and Bars.
- C. ASTM B209 – Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- D. AWS A2.4 – Standard Symbols for Welding, Brazing, Nondestructive Examination.
- E. AWS D1.1/D1.1M – Structural Welding Code Bundled Set B.
- F. SSPC – Steel Structure Painting Council - Steel Structures Painting Council.

1.4 REFERENCES

- A. Refer to specification Section 014100 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 ACTION SUBMITTALS

- A. Product data for products.
- B. Shop drawings detailing fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide templates for anchors and bolts specified for installation under other sections.
- C. Samples representative of materials and finished products as may be requested by Architect.
- D. Delegated-Design Submittal: Submit design calculations for load bearing elements, analysis data and shop drawings indicating compliance with dedicated design requirements signed and sealed by the qualified Florida registered professional engineer responsible for their preparation.

1.6 INFORMATION SUBMITTALS

- A. Welder current certificates signed by Contractor certifying that welders comply with requirements specified under the "Quality Assurance" Article.
- B. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include a list of completed projects with project name, addresses, names of architects and owners, and other information specified.

1.7 QUALITY ASSURANCE

- A. Fabricator Qualifications: Firm experienced in producing metal fabrications similar to those indicated for this Project with a record of successful in-service performance, and with sufficient production capacity to produce required units without delaying the Work.
- B. Welding Standards: Comply with applicable provisions of AWS "Structural Welding Code"
 - 1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone re-certification.
- C. Inserts and Anchorages: Furnish inserts and anchoring devices which must be set in concrete or built into masonry for installation of miscellaneous metal work. Provide setting drawings, templates, instructions, and directions for installation of anchorage devices. Coordinate delivery with other work to avoid delay.
 - 1. See Concrete and Masonry Sections of these Specifications for installation of inserts and anchorage devices.
- D. Shop Assembly: Pre-assemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for re-assembly and coordinated installation.

1.8 FIELD CONDITIONS

- A. Field Measurements: Check actual locations of walls and other construction to which metal fabrications must fit by accurate field measurements before fabrication. Show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- B. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with fabricating products without field measurements. Coordinate construction to ensure that actual dimensions correspond to guaranteed dimensions. Allow for trimming and fitting.

1.9 PERFORMANCE

- A. Delegated-Design: For items subject to loads required by applicable codes and indicated to comply with performance requirements, design criteria, design shall be performed and include analysis data signed and sealed by the qualified Florida registered professional engineer responsible for their preparation.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

- A. Metal Surfaces, General: For metal fabrications exposed to view in the completed Work, provide materials selected for their surface flatness, smoothness, and freedom from surface blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

2.2 FERROUS METALS

- A. Steel Plates, Shapes, and Bars: ASTM A36.
- B. Steel Tubing: Product type (manufacturing method) and as follows:
 - 1. Hot-Formed Steel Tubing: ASTM A501.
 - 2. Hot dipped galvanize finish for exterior installations and where indicated shall comply with ASTM A 53.
- C. Steel Pipe: ASTM A53, standard weight (schedule 40), unless otherwise indicated, or another weight required by structural loads.
 - 1. Black finish, unless otherwise indicated.
 - 2. Hot dipped galvanized finish for exterior installations and where indicated shall comply with ASTM A 53.

2.3 ALUMINUM

- A. Aluminum, General: Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of alloy and temper designated below for each aluminum form required.
- B. Extruded Shapes: ASTM B 221, Alloy 6063-T5/T52 or ASTM B221, Alloy 6063-T6.
- C. Extruded Structural Pipe Round Tubing: ASTM B 429/B 429M, Alloy 6063-T6.
 - 1. Provide Standard Weight (Schedule 40) pipe, unless otherwise indicated.
- D. Drawn Seamless Tubing: ASTM B 210, Alloy 6063-T832.
- E. Plate and Sheet: ASTM B 209, Alloy 6061-T6.
- F. Die and Hand Forgings: ASTM B 247, Alloy 6061-T6.
- G. Castings: ASTM B26/B26M, Alloy 443.0-F.

2.4 ACCESSORIES

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for the metal alloy to be welded.
- B. Concrete Inserts: Threaded or wedge type; galvanized ferrous castings, either malleable iron, ASTM A47, or cast steel, ASTM A27. Provide bolts, washers, and shims as required, hot-dip galvanized, ASTM A153.

2.5 PAINT

- A. Shop Primer for Ferrous Metal:
 - 1. Exterior exposed steel scheduled to be painted if not galvanized: Tnemec Tneme-Zinc 90-97 or equal by Carboline or Ameron.
- B. Galvanizing Repair Paint: High-zinc-dust-content paint for re-galvanizing welds in galvanized steel, with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035 or SSPC-Paint 20.

2.6 FASTENERS/ANCHORS

- A. General: Unless otherwise indicated, provide Type 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
 - 1. Provide stainless-steel fasteners for fastening aluminum.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.

2.7 GROUT

- A. Non-shrink, Nonmetallic Grout: Factory-packaged, non-staining, non-corrosive, nongaseous grout complying with ASTM C1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- B. Products: Subject to compliance with requirements, provide one of the following:
 - 1. B-6 Construction Grout; W. R. Bonsal Co.
 - 2. Sure-grip High Performance Grout; Dayton Superior Corp.
 - 3. Euco N-S Grout; Euclid Chemical Co.
 - 4. Five Star Grout; Five Star Products.
 - 5. Crystex; L & M Construction Chemicals, Inc.
 - 6. Masterflow 928 and 713; Master Builders Technologies, Inc.
 - 7. Sealtight 588 Grout; W. R. Meadows, Inc.

2.8 FABRICATION

- A. Form metal fabrications from materials of size, thickness, and shapes indicated but not less than that needed to comply with performance requirements indicated. Work to dimensions indicated

or accepted on shop drawings, using proven details of fabrication and support. Use type of materials indicated or specified for various components of each metal fabrication.

- B. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.
- C. Allow for thermal movement resulting from the following maximum change (range) in ambient temperature in the design, fabrication, and installation of installed metal assemblies to prevent buckling, opening up of joints, and overstressing of welds and fasteners. Base design calculations on actual surface temperatures of metals due to both solar heat gain and nighttime sky heat loss.
 - 1. Temperature Change (Range): 100 degrees Fahrenheit (37.78 degrees Celsius).
- D. Shear and punch metals cleanly and accurately. Remove burrs.
- E. Ease exposed edges to a radius of approximately 1/32 inch (0.79 mm), unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- F. Remove sharp or rough areas on exposed traffic surfaces.
- G. Weld corners and seams continuously to comply 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. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing, and contour of welded surface matches those adjacent.
- H. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
- J. Shop Assembly: Pre-assemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for re-assembly and coordinated installation.
- K. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- L. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.
- M. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (0.79 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- N. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- O. Form exposed work with accurate angles and surfaces and straight edges.
- P. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- Q. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches (38 mm), with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches (203.2 mm) from ends and corners of units and 24 inches (609.6 mm) o.c., unless otherwise indicated.

2.9 MISCELLANEOUS METAL FABRICATIONS

- A. Rough Hardware
 - 1. Furnish bent, or otherwise custom-fabricated, bolts, plates, anchors, hangers, dowels, and other miscellaneous steel and iron shapes as required for framing and supporting woodwork, and for anchoring or securing woodwork to concrete or other structures. Straight bolts and other stock rough hardware items are specified in Division 06 Sections.
 - 2. Fabricate items to sizes, shapes, and dimensions required. Furnish malleable-iron washers for heads and nuts that bear on wood structural connections, and furnish steel washers elsewhere.
- B. Loose Bearing and Leveling Plates: Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction, made flat, free from warps or twists, and of the required thickness and bearing area. Drill plates to receive anchor bolts and for grouting as required. Galvanize after fabrication.

2.10 MISCELLANEOUS FRAMING

- A. Countertop Supports:
 - 1. Provide stainless steel countertop supports for wall mounted countertops from 14-gauge sheet steel. Provide a triangle brace with top horizontal length two thirds of countertop depth and vertical portion to be secured to wall to be one half of countertop length. Fold all edge with 1" fold and all exposed edges to be hemmed. Supports shall be located at 30" o.c.
 - 2. Surface mounted counter support brackets fabricated from 2" x 2" x 0.188" thick aluminum.
 - 3. Basis of Design: "Rakks EH-Inside Wall Mount Counter Support Bracket" as manufactured by Rangine Corporation.
 - a. (CS-1) Model #EH-1212FM, 12" x 14" bracket, supports 430#.
 - b. (CS-2) Model #EH-1818FM, 18" x 20" bracket, supports 300#.
 - c. (CS-3) Model #EH-1824FM, 18" x 26" bracket, supports 300#.
 - d. Finish: As selected by the Architect.
 - 4. Hidden countertop brackets fabricated from 1/2" thick x 2 1/2" wide x 12" long steel.
 - a. Basis of Design: "Hidden Countertop Supports" as manufactured by Centerline Brackets.
 - 1) (CS-4) Model #CSA-0008-12
 - 5. Finish: As selected by the Architect.

2.11 LADDERS

- A. Steel Ladders:
 - 1. Fabricate ladders for the locations shown, with dimensions, spacings, details, and anchorages as indicated. Comply with requirements of ANSI A14.3 and OSHA.
 - 2. Siderails: Continuous, steel, 1/2-by-2 1/2-inch flat bars or bent plate, with eased edges, spaced 18 inches (457.2 mm) apart.
 - 3. Rungs: 3/4-inch- diameter steel bars, spaced 12 inches (304.8 mm) o.c.
 - 4. Fit rungs in centerline of side rails, plug weld and grind smooth on outer rail faces.
 - 5. Provide non-slip surfaces on top of each rung, either by coating the rung with aluminum-oxide granules set in epoxy-resin adhesive, or by using a type of manufactured rung that is filled with aluminum-oxide grout.
 - 6. Exterior mounted roof access ladder to have over roof handrail extension. Extension shall be a continuation of the ladder siderails up to 42" above the height of the adjacent roof edge. The extensions shall be bent to provide a 24" wide opening between the extensions to the roof. A 1 1/2 diameter by 30" high handrail shall be located on the roof side of the extensions and shall start 2" from the top of the extension. The handrail shall be u-shaped and extend 12" from the face of the extension towards the roof.
 - 7. Galvanize ladders:
 - a. Exterior locations.

2.12 MISCELLANEOUS STEEL TRIM

- A. Unless otherwise indicated, fabricate units from structural steel shapes, plates, and bars of profiles shown with continuously welded joints, and smooth exposed edges. Miter corners and use concealed field splices wherever possible and grind welds smooth and finish flush where exposed to view.
- B. Provide cutouts, fittings, and anchorages as required to coordinate assembly and installation with other work. Provide anchors, welded to trim, for embedding in concrete or masonry construction, spaced not more than 6 inches (152.4 mm) from each end, 6 inches from corners, and 24 inches (609.6 mm) o.c., unless otherwise indicated.
- C. Galvanize miscellaneous steel trim in the following locations:
 - 1. Exterior locations.

2.13 MISCELLANEOUS ALUMINUM TRIM

- A. Unless otherwise indicated, fabricate units from extruded aluminum shapes, plates, and bars of profiles shown with continuously welded joints, and smooth exposed edges. Miter corners and use concealed field splices wherever possible and grind welds smooth and finish flush when exposed to view.
 - 1. Provide anchorages as required to coordinate assembly and installation with other work and if exposed approved by the Architect.

2.14 FINISHES – GENERAL

- A. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to applying and designing finishes.
 - 1. Finish metal fabrications after assembly.
- B. Finishes – Steel
 - 1. Prepare surfaces to be primed in accordance with SSPC SP 2.
 - 2. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
 - 3. Do not prime surfaces in where field welding is required.
 - 4. Interior Steel Members: Prime paint items with one coat.
 - 5. Exterior Steel Members:
 - a. Galvanize after fabrication to ASTM A123/A123M.
 - b. Provide minimum G90 galvanized coating.
- C. Finishes – Aluminum
 - 1. Aluminum Surfaces: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Sections shall be free of scratches and other serious surface blemishes and chemically cleaned.
 - 2. Finish: To be selected by the Architect.
 - a. Clear Anodic Finish: Class 1, AAMA 611, AA-M12C22A41, Mechanical finish, nonspecular as fabricated, chemical finish, 0.7 mils (0.01778 mm) or thicker.
 - b. Colored Anodic Finish: Class 2, AAMA 611, AA-M12C22A32/A34, Mechanical finish, nonspecular as fabricated, integral colored, chemical finish, 0.4 mils (0.01016 mm) or thicker. Verify availability with manufacturers selected.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Installer must examine the areas and conditions under which miscellaneous and ornamental items are to be installed. Notify the Contractor in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

3.2 PREPARATION

- A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installing anchorages, including concrete inserts, sleeves, anchor bolts, and miscellaneous items having integral anchors that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.
- B. Set sleeves in concrete with tops flush with finish surface elevations. Protect sleeves from water and concrete entry.

3.3 INSTALLATION

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction. Include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors as required.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing miscellaneous metal fabrications. Set metal fabrication accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete masonry or similar construction.
- D. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop-welded because of shipping size limitations. Do not weld, cut, or abrade the surfaces of exterior units that have been hot-dip galvanized after fabrication and are intended for bolted or screwed field connections.
- E. Field Welding: Comply with the following requirements:
 - 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. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing, and contour of welded surface matches those adjacent.
- F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

3.4 SETTING LOOSE PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of bearing plates.
- B. Set loose leveling and bearing plates on wedges or other adjustable devices. After the bearing members have been positioned and plumbed, tighten the anchor bolts. Do not remove wedges or shims, but if protruding, cut off flush with the edge of the bearing plate before packing with grout.
 - 1. Use non-shrink, metallic grout in concealed locations where not exposed to moisture; use non-shrink, nonmetallic grout in exposed locations, unless otherwise indicated.
 - 2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.5 INSTALLING LADDERS

- A. CMU/Concrete Walls: Ladder to be attached directly to floor and wall.
- B. Metal Stud Partitions: Ladder to be attached directly to floor and wall.

3.6 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

- B. Anchor supports for securely to, and rigidly brace from, building structure.

3.7 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a 2.0-mil minimum dry film thickness.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of the shop paint on miscellaneous metal is specified in Division 09 Section "Painting."
- C. For galvanized surfaces, clean welds, bolted connections, and abraded areas, and apply galvanizing repair paint to comply with ASTM A780.

3.8 WASTE MANAGEMENT

- A. Collect cutoffs and scrap and place in designated areas for recycling.
- B. Coordinate with manufacturer and local recycler for take-back program or recycling. Set aside scrap to be returned to manufacturer for recycling into new product.

END OF SECTION

SECTION 06 10 00 - ROUGH CARPENTRY (BEAM)

PART 1 GENERAL

1.1 1 RELATED DOCUMENTS

- A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

- A. Preservative treated wood materials.
- B. Concealed wood blocking, nailers, and supports.
- C. Miscellaneous wood nailers, furring, and grounds.

1.3 REFERENCE STANDARDS

- A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- C. ALSC (American Lumber Standards Committee) – Softwood Lumber Standards.
- D. EWA (The Engineered Wood Association).
- E. APA (American Plywood Association).
- F. AWP A U1 – Use Category System - User Specification for Treated Wood.
- G. AWP A P5 – Standard for Waterborne Preservatives.
- H. ICC-ES Standards.
- I. AWP A U1 - Use Category System: User Specification for Treated Wood; 2025.
- J. PS 1 - Structural Plywood; 2023.
- K. PS 2 - Performance Standard for Wood Structural Panels; 2018.
- L. PS 20 - American Softwood Lumber Standard; 2025.

1.4 REFERENCES:

- A. Refer to specification Section 01 41 00 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 SUBMITTALS

- A. See Section 013000 – Administrative Requirements and Section 016000 – Product Requirements for submittal procedures.
- B. Product Data: Provide technical data on insulated sheathing, wood preservative materials, and application instructions.
- C. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
 - 2. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
 - 3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.6 INFORMATION SUBMITTALS

- A. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.
- B. Evaluation Reports: For the following, from ICC-ES:
 - 1. Wood-preservative-treated wood.

1.7 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing agency providing classification marking for treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.8 FIELD CONDITIONS

- A. Examine substrates and supporting structure and the conditions under which work is to be installed. Do not proceed with the installation until unsatisfactory conditions have been corrected.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Stack wood products flat with spacers beneath and between each bundle to provide air circulation. Protect wood products from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.
 - 1. For lumber and plywood pressure treated with waterborne chemicals, place spacers between each bundle to provide air circulation.
 - 2. Keep treated wood waste separated from other wood to be recycled or reused as mulch. Discard in a legal manor.

PART 2 PRODUCTS

2.1 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.
- B. Lumber fabricated from old growth timber is not permitted.
- C. Fire retardant wood (FRTW) is NOT PERMITTED in FDOE SREF projects in accordance with FBC -Building Section 453.11. Concealed blocking can be pressure treated.

2.2 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

- A. General:
 - 1. Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including blocking, nailers, and similar items.
 - 2. Lumber for blocking may be any grade and classified standard and better for western species or classified No. 2 for Southern Pine SPIB. Plywood shall not be used for blocking materials.
 - 3. Provide lumber for support or attachment of other construction including rooftop equipment curbs and support bases, grounds, and similar members.
 - 4. Fabricate miscellaneous lumber from dimension lumber of sizes indicated and into shapes shown.
 - 5. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

6. Wood grounds, nailers, and sleepers shall be pressure treated as specified herein. The manufacturer and applicator of pressure treatment shall mark all wood.
 7. No wood grounds, nailers, blocking and sleepers shall be permitted inside the building, unless indicated otherwise.
- B. Sizes: Nominal sizes as indicated on drawings, S4S.
- C. Moisture Content: S-dry or MC19.
- D. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
1. Lumber: S4S, No. 2 or Standard Grade.
 2. Boards: Standard or No. 3.

2.3 CONSTRUCTION PANELS

- A. General:
1. Construction and Industrial Plywood" for plywood construction panels and, for products not manufactured under PS 1 provisions, with APA PRP-108. Furnish construction panels that are each factory-marked with APA trademark. Furnish construction panels that are each factory-marked with APA trademark.
 - a. Panels: Exterior AC plywood 1/2" and 3/4" as indicated on the drawings.
- B. Roof Sheathing: PS 2 type, rated Structural I Sheathing.
1. Bond Classification: Exterior.
 2. Span Rating: 60.
 3. Performance Category: 3/4 PERF CAT.
- C. Other Applications:
1. Plywood Concealed From View But Located Within Exterior Enclosure: PS 1, C-C Plugged or better, Exterior grade.
 2. Plywood Exposed to View But Not Exposed to Weather: PS 1, A-D, or better.
 3. Other Locations: PS 1, C-D Plugged or better.

2.4 ACCESSORIES

- A. Fasteners and Anchors:
1. Metal and Finish: Hot-dipped galvanized steel per ASTM A 153/A 153M for high humidity, all exterior lumber, lumber installed in roof assemblies and preservative-treated wood locations. Unfinished steel is acceptable elsewhere.
 2. Hot-dipped galvanized steel per ASTM A 153/A 153M for high humidity, all exterior lumber. Unfinished steel is acceptable elsewhere.
 3. Nails, Wire, Brads, and Staples: FS FF-N-105.
 4. Power Driven Fasteners: National Evaluation Report NER-272.
 5. Wood Screws: ASME B18.6.1.
 6. Screws for Fastening to Metal Framing: ASTM C 954, except with wafer heads and reamer wins, length as recommended by screw manufacturer for material being fastened.
 7. Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).
 8. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.
 9. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
 - a. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
 10. Provide stainless steel fasteners for lumber assemblies installed at roof assemblies and other preservative-treated wood locations.

2.5 FACTORY WOOD TREATMENT

- A. Treated Lumber and Plywood: Comply with requirements of AWWA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
 - 1. 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 AWWA standards.
- B. Preservative Treatment:
 - 1. Products:
 - a. Arch Wood Protection, Inc; SillBor: www.wolmanizedwood.com.
 - b. Koppers Performance Chemicals, Inc.; www.koppersperformancechemicals.com/#sle.
 - c. Viance, LLC; Preserve ACQ: www.treatedwood.com/#sle.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
 - 2. Preservative Pressure Treatment of Lumber Above Grade: AWWA U1, Use Category UC3B, Commodity Specification A using borate to 0.25 lb/cu ft retention.
 - a. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
 - b. Treat lumber in contact with roofing, flashing, or waterproofing.
 - c. Treat lumber in contact with masonry or concrete.
 - d. Treat lumber in other locations as indicated.

PART 3 EXECUTION

3.1 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.
- D. Protect treated wood from the weather. Store according to the manufacturer's recommendations.

3.2 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 metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.
- C. 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.
- D. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.
- E. Attach to substrates as required to support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise indicated. Build into masonry during installation of masonry work. Where possible, anchor to formwork before concrete placement.
- F. Install permanent grounds of dressed, preservative treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material involved. Remove temporary grounds when no longer required.
- G. 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.

3.3 INSTALLATION OF CONSTRUCTION PANELS

- A. Screw attach to metal decking with #10 self-tapping, galvanized deck screws.
- 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.
- D. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches (610 mm) on center on all edges and into studs in field of board.
 1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
 2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
 3. Install adjacent boards without gaps.
 4. Size: 48 by 96 inches (2440 by 4880 mm), installed horizontally at ceiling height.
- E. Cement Bonded Particleboard Flooring.
 1. Install with screws recommended by the manufacturer.
 2. Install in a bed of construction adhesive - 1/4" minimum bead size.

3.4 TOLERANCES

- A. Framing Members: 1/4 inch (6 mm) from true position, maximum.
- B. 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.

3.5 CLEANING

- A. Waste Disposal: See Section 01 74 19 - 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

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SECTION 06 41 16 - PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES:

- A. Plastic-laminate-faced architectural cabinets.

1.3 REFERENCE STANDARDS

- A. ANSI A135.4 - Basic Hardboard; 2012 (Reaffirmed 2020).
- B. ANSI A208.1 - American National Standard for Particleboard; 2022.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
- D. BHMA A156.9 - Cabinet Hardware; 2020.
- E. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.
- F. PS 1 - Structural Plywood; 2023.
- G. PS 20 - American Softwood Lumber Standard; 2025.
- H. Plywood Product Standards: Comply with PS 1 (ANSI A199.1) or, for products not manufactured under PS 1 provisions, with applicable APA Performance Standard PRP-108 for type of panel indicated.
- I. ANSI/APA (American National Standards Institute/American Plywood Association).
- J. Grading rules of Southern Pine.

1.4 REFERENCES

- A. Refer to specification Section 01 41 00 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work..

1.5 ACTION SUBMITTALS

- A. See Section 01 30 00 – Administrative Requirements and Section 01 60 00 – Product Requirements for submittal procedures.
- B. Product Data: For each type of product.
- C. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
 - 1. Show details full size.
 - 2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
 - 3. Show locations and sizes of cutouts and holes for electrical switches and outlets and other items installed in architectural plastic-laminate cabinets.
- D. Samples: For verification.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For fabricator.
- B. Product Certificates: For each type of product, signed by product manufacturer.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Employ only manufacturers with at least five (5) years experience making the specified materials as a current catalog and regular production item. Manufacturer

shall employ skilled workers who custom fabricate products similar to those required for this Project .

- B. Contractor Qualifications: Employ only experienced Contractors (Installers) skilled in the successful installation of the specified materials and assemblies on similar projects for a minimum of five (5) years .
- C. Source Limitations: Provide products of the same manufacturer for all cabinets.
- D. All cabinets shall comply with AWI's Woodwork Quality Standards for grades of interior architectural woodwork, construction, finishes and other requirements.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver cabinets until painting and similar operations that could damage woodwork have been completed in installation areas. If cabinets must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. All cabinets shall be manufactured in a climate-controlled environment, stored after fabrication in a climate controlled (temperature and humidity) storage area and shipped to the jobsite in an enclosed container (semi-tractor trailer).
- C. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- D. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed, and indicate measurements on Shop Drawings.
- E. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.
- F. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other sections to ensure that cabinets can be supported and installed as indicated.

1.10 WARRANTY

- A. Cabinet Manufacturer shall warrant all casework products against manufacturing defects in materials and workmanship for a period of five (5) years.
- B. Manufacturer shall warrant against structural failure of the cabinet body for a period of ten (10) years.
- C. Installers Warranty: The installer shall warrant the entire installation against defects in material and workmanship for a period of one (1) years.
- D. Duration of all warranties shall begin on the date of Substantial Completion.
- E. Products will be repaired or replaced by Manufacturer, without cost to the Owner.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturer shall be one of the following however products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and

functional qualities of the specified product and acceptance is provided by the Architect in writing prior to bidding.

1. Case Systems
2. ICI Campbell Rhea
3. Wenger

B. See Section 013300 - Submittal Procedures for submittal procedures.

2.2 PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of architectural plastic-laminate cabinets indicated for construction, finishes, installation, and other requirements.
1. Provide labels and certificates from AWI certification program indicating that woodwork, including installation, complies with requirements of grades specified.
 2. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with those selections and requirements in addition to the quality standard.
- B. Grade: Premium
- C. Type of Construction: Frameless.
- D. Cabinet, Door, and Drawer Front Interface Style: Flush overlay.
- E. Reveal Dimension: 1/2"
- F. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by woodwork quality standard.
1. Basis of Design: Eggers.
 2. Laminate Cladding for Exposed Surfaces:
 - a. Horizontal Surfaces: Grade HGS.
 - b. Post-Formed Surfaces: Grade HGP
 - c. Vertical Surfaces: Grade VGS
 - d. Edges: Match laminate in color, pattern, and finish.
 3. Materials for Semi-Exposed Surfaces:
 - a. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, NEMA LD 3, Grade CLS.
 - b. Edges of Plastic Laminate Shelves: Match laminate in color, pattern, and finish.
 - c. For semi-exposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, NEMA LD 3, Grade CLS.
 4. Drawer Sides and Backs: High-pressure decorative laminate, NEMA LD 3, Grade BKL.
 5. Drawer Bottoms: High-pressure decorative laminate, NEMA LD 3, Grade BKL.
 6. Dust Panels: 1/4-inch (6.4-mm) tempered hardboard above compartments and drawers unless located directly under tops.
 7. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.
 8. Colors, Patterns, and Finishes: Premium finish, color as selected by Architect from Manufacturer's full range.

2.3 MATERIALS

- A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
1. Wood Moisture Content: 5 to 10 percent.
- B. Core Material:
1. Panel Association (CPA A208.2), formaldehyde-free (Cabinets and countertops).
 2. Softwood Plywood: 3/4" CDX pressure treated plywood DOC PS 1.
 3. Softwood Plywood: 3/4" and as indicated, AC pressure DOC PS 1.

4. Particleboard: 3/4" or as noted and complying with ANSI A208.1, Grade M-2
 5. Hardboard: 1/4" tempered smooth both sides conforming to ANSI A135.4.
 6. Lumber: Solid wood hardwood, 1/2", 3/4" or as indicated kiln-dried, select Poplar, Fir or Grade III mill option.
 7. Lumber: Solid wood hardwood, 1/2", 3/4" or as indicated kiln-dried, select Poplar, Fir or Grade III mill option (Framing).
- C. Adhesive: Water based low Volatile Organic Compound (VOC) Non-toxic, PVA adhesive.
1. Laminates:
 2. VGS (.028) NEMA LD 3 – Vertical Grade, High Pressure Decorative Laminate
 3. HGS (.048) NEMA LD 3 – Horizontal Grade, High Pressure Decorative Laminate
 4. CLS (.020) NEMA LD 3 – High Pressure Cabinet Liner
 5. BKH (.028) NEMA LD 3 – High Pressure Backer
- D. Fire retardant wood (FRTW) is NOT PERMITTED in FDOE SREF projects in accordance with FBC -Building Section 453.11. Concealed blocking can be pressure treated.

2.4 MISCELLANEOUS MATERIALS

- A. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.
- B. Adhesives: Do not use adhesives that contain urea formaldehyde.
- C. Adhesives: Use adhesives that meet the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.5 HARDWARE

- A. Hinges: Steel institutional five knuckle with interlaying leaves, 0.095 inch (2.41 mm) thick steel with hospital tips.
- B. Door Catches: Provide magnetic, self-aligning or heavy duty, spring loaded, large 11/16" diameter roller mounted catch at bottom edge of door to protect adjacent surfaces that are within the door swing. All doors over 48" in height shall have top and bottom catches.
- C. Pulls: Solid 5" stainless-steel wire pulls 2, fastened from back with two screws. Provide two pulls for drawers more than 24 inches (609.6 mm) wide. Pull design shall comply with Americans with Disability Act (ADA).
- D. Adjustable Shelf Supports: Injection molded polycarbonate (clear color), friction fit into cabinet and panels and vertical dividers, adjustable on 1 – 1/4" centers. Each shelf support with two (2) integral supports pins, 0.2 inch (5 mm) diameter, to interface pred-drilled holes and prevent accidental rotation of support. Supports automatically adaptable to 3/4" or 1" thick shelving and provide no-tip feature for shelving.
- E. Shelf Supports: BHMA A156.9, B04013; metal.
- F. Drawer Slides: Accuride standard clear zinc finish, ball bearing rollers and 75 pounds dynamic load, and file drawer slides shall be rated for 150 pounds when fully extended.
- G. Locks: Cylinder type with 5-disc tumbler mechanism and keyed to room entry door. Locks shall be provided for all doors and drawers, on pair of doors the left leaf shall be provided with a concealed spring-loaded manual latch and the lock shall be located on the right door. Each area or room shall be keyed alike.
1. Provide locks on all doors and drawers.
- H. Finish: Satin stainless steel or as to match existing.

2.6 CABINET CONSTRUCTION

- A. Countertops and Backsplashes:
 - 1. See drawings and specifications for additional types of countertops.
 - 2. Plastic countertops where indicated on drawings to be provided.
 - 3. Countertops: 1-1/4-inch thick and with high pressure plastic laminate.
 - 4. Backsplashes: 3/4" particleboard with high pressure plastic laminate.
 - 5. Provide 3/4" plywood in wet areas containing sinks for countertops and back splashes.
 - 6. Provide 1" radius at exposed corners.
- B. Base: 4- inch high, 3/4" pressure treated plywood, furnish additional supports for cabinets over 24" wide.
 - 1. CDX Exterior Grade MR Plywood is acceptable for this application; Note that Florida schools do not permit the use of fire retardant wood in schools.
- C. Body: 3/4" Grade M-2 particleboard
 - 1. Tops, bottoms and sides to be glued and paneled.
 - 2. High Pressure Plastic Laminate.
- D. Cabinet Backs: Cabinet back shall be 1/2" particleboard and shall be fully bound (dadoed) into sides, top and bottom, recessed 7/8" from the cabinet rear. Rear, unexposed side of back shall be toe-nailed to cabinet body with mechanical fasteners and solidified with a continuous bead of industrial grade hot melt adhesive to withstand a bond test as described in ANSI/WDMA I.W.1A. All cabinet backs shall have laminate clad flush mounting blocks (hang rails).
 - 1. Hang rails shall be 3/4" x 4" plywood and located at rear of cabinet back and on the inside and fastened to cabinet sides. Provide 2 hang rails at wall cabinet, 1 hang rail at base cabinet and three hang rails at tall cabinets.
- E. Doors: 3/4" particleboard.
 - 1. Front and back: High Pressure Laminate.
- F. Shelving: 3/4" particleboard, maximum 36" unsupported width.
 - 1. Top and Bottom: High pressure laminate.
 - 2. Provide 1" radius at exposed corners in open shelving.
 - 3. Shelves shall be full depth.
- G. Drawer:
 - 1. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.
 - 2. Join sub-fronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners.
 - 3. Front: 3/4" particleboard with high pressure laminate face with cabinet liner on the back.
 - 4. Bottom: 1/2", plywood fully bound (dadoed) into front, sides and back laminated with cabinet liner.
 - 5. Sides: 1/2" thick hardwood.
- H. Body, Door, Drawer and Shelves Edges
 - 1. Edges: High Pressure Laminate.
- I. Construction Tolerances
 - 1. Gap between doors, drawers, panels and frames shall be 1/8".
- J. Fabricate cabinets to dimensions, profiles, and details indicated.
- K. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
- L. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to

produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

2.7 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.
- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.
- C. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement.
 - 1. Adhesive for Bonding Edges: Hot-melt adhesive.

PART 3 EXECUTION

3.1 GENERAL

- A. Before installing cabinets, examine shop-fabricated work for completion and complete work as required.

3.2 INSTALLATION

- A. Do not start installation until the building is enclosed and the HVAC system controls the temperature and humidity (75 degrees, 55 RH) in the room space.
- B. Erect the cabinets plumb, level, true and straight with no distortions. Countertops shall be installed to within 1/8-inch of level in a 10-foot length.
- C. All cabinet faces shall be plumb and true from door face to door face. There shall be no side hanging or non-plumb doors. Seams shall be flush.
- D. Assemble cabinets and complete fabrication at Project site to the extent that it was not completed in the shop.
- E. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- F. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.
 - 1. Use filler matching finish of items being installed.
- G. Cabinets: Install without distortion so 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 installation of hardware and accessory items as indicated.
 - 1. Install cabinets with no more than 1/8 inch (3.18 mm) in 96-inch (0.12 inch (3 mm) in 2400-mm) sag, bow, or other variation from a straight line.
 - 2. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches (406.4 mm) o.c. with No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.
 - 3. Caulk all cabinets and countertops to adjacent wall surfaces

3.3 SPECIAL INSTALLATION PROCEDURE / ADJUSTMENT PROCEDURES

- A. Provide all items and accessories as required for a total and complete installation in every respect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected. Installation of any items indicates all conditions are satisfactory and acceptance of previous Work by other Contractors.
- C. Adjust cabinets and hardware so that doors and drawers operate smoothly.

3.4 CLEANING

- A. All modular cabinet surfaces shall be cleaned of construction spoils, dirt, spills, dust and stains. The modular cabinet manufacturer shall recommend cleaning solvent. Clean all surfaces, edges and cabinet interiors.
- B. Remove and dispose of all packing materials and related construction debris.
- C. Protection: Protect casework from damage during construction until date of Substantial Completion, replace damaged work.

END OF SECTION

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SECTION 07 01 50.19 - PREPARATION FOR RE-ROOFING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specification and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

- A. Removal of existing roofing system in preparation for entire new roofing system.
- B. Removal of existing flashing and counter-flashings.
- C. Temporary roofing protection.

1.3 REFERENCES

- A. Refer to specification Section 014100 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate with affected mechanical and electrical work associated with roof penetrations.
- B. Preinstallation Meeting: Convene one week before starting work of this section.
 - 1. Attendees:
 - a. Architect.
 - b. Contractor.
 - c. Town of Canton.
 - d. Installer.
- C. Schedule work to coincide with commencement of installation of new roofing system.

1.5 ACTION SUBMITTALS

- A. See Section 013000 – Administrative Requirements and Section 016000 – Product Requirements for submittal procedures.
- B. Product Data: Submit for each type of material.
- C. Shop Drawings: Indicate size, configuration, and installation details.

1.6 QUALITY ASSURANCE

- A. Materials Removal Company Qualifications: Company specializing in performing work of type specified with at least three years of documented experience.
 - 1. Comply with removal and disposal regulations of local authorities having jurisdiction (AHJ).

1.7 DELIVERY, STORAGE, AND HANDLING

- A. See Section 01 74 19 - Construction Waste Management and Disposal for demolition waste requirements.

1.8 FIELD CONDITIONS

- A. Existing Roofing System: TPO roofing.
- B. Do not remove existing roofing membrane when weather conditions threaten the integrity of building contents or intended continued occupancy.
- C. Maintain continuous temporary protection prior to and during installation of new roofing system.
- D. Provide notice at least three days before starting activities that will affect normal building operations.
- E. Verify that occupants have been evacuated from building areas when work on structurally impaired roof decking is scheduled to begin.

- F. Town of Canton will occupy building areas directly below re-roofing area.
 - 1. Provide Town of Canton with at least 48 hours written notice of roofing activities that may affect their operations and to allow them to prepare for upcoming activities as necessary.
 - 2. Do not disrupt Town of Canton's operations or activities.
 - 3. Maintain access of Town of Canton's personnel to corridors, existing walkways, and adjacent buildings.

PART 2 PRODUCTS

2.1 COMPONENTS

- A. See the following sections for additional information on components relating to this work:
 - 1. Replacement and removal of existing roofing system in preparation for entire new roofing system, see Section 075423.
 - 2. Remove existing flashing and counter-flashings in preparation for replacement of these materials as part of this work, see Section 07 62 00 for material requirements.

2.2 MATERIALS

- A. Patching Materials: Provide necessary materials in accordance with requirements of existing roofing system.
- B. Temporary Roofing Protection Materials:
 - 1. Contractor's responsibility to select appropriate materials for temporary protection of roofing areas as determined necessary for this work.

2.3 ACCESSORIES

- A. Fasteners: Type and size as required and compatible with existing and new roofing system to resist local wind uplift.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that existing roof surface has been cleared of materials being removed from existing roofing system and ready for next phase of work as required.

3.2 PREPARATION

- A. Sweep roof surface clean of loose matter.
- B. Remove loose refuse and dispose of properly off-site.

3.3 MATERIAL REMOVAL

- A. Remove only existing roofing materials that can be replaced with new materials the same day.
- B. Remove metal counter flashings.
- C. Remove damaged insulation and fasteners, cant strips, and blocking.

3.4 INSTALLATION

- A. Coordinate scope of this work with requirements for installation of new roofing system, see Section 07 52 00 and 07 31 13 for additional requirements.

3.5 PROTECTION

- A. Provide protection of existing roofing system that is not having work performed on it.
- B. Do not permit traffic over unprotected or repaired deck surface.

END OF SECTION

SECTION 07 19 00 - WATER REPELLENTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specification and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

- A. Water repellents applied to exterior and interior, masonry, stone, and concrete surfaces.
- B. Pressure washing.
- C. Concrete etching.

1.3 REFERENCE STANDARDS

- A. ASTM C140/C140M - Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units; 2023a.
- B. ASTM C642 - Standard Test Method for Density, Absorption, and Voids in Hardened Concrete; 2021.
- C. ASTM D3960 - Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings; 2025.
- D. ASTM D5095 - Standard Test Method for Determination of the Nonvolatile Content in Silanes, Siloxanes and Silane-Siloxane Blends Used in Masonry Water Repellent Treatments; 1991 (Reapproved 2022).
- E. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.

1.4 REFERENCES

- A. Refer to specification Section 01 41 00 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene a meeting at least one week prior to starting work; require attendance of affected installers; invite Architect and Town of Canton.

1.6 ACTION SUBMITTALS

- A. See Section 01 30 00 – Administrative Requirements and Section 01 60 00 – Product Requirements for submittal procedures.
- B. Product Data: Provide product description, details of tests performed, limitations, chemical composition.
- C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention; cautionary procedures required during application.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Manufacturer's Field Reports: Report whether manufacturer's "best practices" are being followed; if not, state corrective recommendations. Email report to Architect the same day as inspection occurs; mail report on manufacturer's letterhead to Architect within 2 days after inspection.
- F. Manufacturer's Qualification Statement.
- G. Installer's Qualification Statement.
- H. Maintenance Materials: Furnish the following for Town of Canton's use in maintenance of project.

1. See Section 01 60 00 - Product Requirements for additional provisions.
2. Extra Water Repellent Material: Two gallons (9 liters) of type installed.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.
- B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience
- C. Town of Canton reserves the right to provide continuous independent inspection of surface preparation and application of water repellent.

1.8 MOCK-UPS

- A. See Section 01 40 00 - Quality Requirements for additional requirements.
- B. Prepare representative surface 36 by 36 inches (0.91 by 0.91 m) in size using specified materials and preparation and application methods on surfaces identical to those to be coated; approved mock-up constitutes standard for workmanship.
- C. For proposed substitutions, prepare side-by-side mock-ups of specified and substitute products.
- D. Locate where directed.
- E. Mock-up may remain as part of work.

1.9 FIELD CONDITIONS

- A. Protect liquid materials from freezing.
- B. Do not apply water repellent when ambient temperature is lower than 50 degrees Fahrenheit (10 degrees Celsius) or higher than 100 degrees Fahrenheit (37.78 degrees Celsius).
- C. Do not apply water repellents when wind velocity is higher than 10 mph (16 kph).

1.10 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Silane, Siloxane, Silane-Siloxane Blend, and Siliconate Water Repellents:
 1. Evonik Corporation; Protectosil CHEM-TRETE BSM 400: www.evonik.com/#sle.
 2. Pecora Corporation; KlereSeal 910-W/920-W Water-Based Penetrating Masonry Sealer: www.pecora.com/#sle.
 3. Nox-Crete Inc; Natraseal: www.nox-crete.com/#sle.
 4. Pittsburgh Paints: www.pittsburghpaintsco.com/#sle.
 5. Sherwin-Williams Company; Loxon XP: www.sherwin-williams.com/#sle.
 6. Tex-Cote LLC; TEX-COTE RAINSTOPPER 120: www.texcote.com/#sle.
 7. Substitutions: See Section 01 60 00 - Product Requirements.

2.2 MATERIALS

- A. Specific product to be used will be determined by side-by-side mock-up testing of at least three products meeting specified requirements; prepare mock-ups as specified above; submit cost breakdown for each product used in mock-up, including both unit and total costs.
- B. Water Repellent: Non-glossy, colorless, penetrating, water-vapor-permeable, non-yellowing sealer, that dries invisibly leaving appearance of substrate unchanged.
 1. Applications: Vertical surfaces and non-traffic horizontal surfaces.
 2. Number of Coats: Two.
 3. VOC Content: See Section 01 61 16.

4. VOC Content: Less than 30 g/L, when tested in accordance with ASTM D3960 or ASTM D5095.
5. Moisture Absorption When Applied to Masonry: Five percent, maximum, when tested in accordance with ASTM C140/C140M using masonry sample completely coated with water repellent.
6. Moisture Absorption When Applied to Concrete: Five percent, maximum, when tested in accordance with ASTM C642 concrete sample completely coated with water repellent.
7. Maintains dry appearance when wetted.
8. Silane, siloxane, silane-siloxane blend, or silicate that reacts chemically with concrete, masonry, and acts as graffiti repellent.
 - a. Manufacturers:
 - 1) Advanced Chemical Technologies, Inc; SIL-ACT ATS-100, with VOC of 350 g/L or less: www.advchemtech.com/#sle.
 - 2) Mapei Corporation; Planiseal WR 100: www.mapei.com/#sle.
 - 3) Nox-Crete Inc; Acryl Pen Series: www.nox-crete.com/#sle.
 - 4) PROSOCO, Inc; Consolideck SL100 Water Repellent, with VOC of 400 g/L or less: www.prosoco.com/#sle.
 - 5) RainguardPro; Micro-Seal Silane/Siloxane with MICRO-LOK: www.rainguardpro.com/#sle.
 - 6) Sherwin-Williams Company; Loxon 40 percent Low VOC Silane Water Repellant, with VOC of 343 g/L or less: www.sherwin-williams.com/#sle.
 - 7) W. R. Meadows, Inc; PENTREAT 244-40: www.wrmeadows.com/#sle.
 - 8) Substitutions: See Section 01 60 00 - Product Requirements.
9. Water-based siloxane, silane, or blend that reacts chemically with concrete and masonry.
 - a. Manufacturers:
 - 1) Mapei Corporation; Planiseal WR 40: www.mapei.com/#sle.
 - 2) Nox-Crete Inc; Stifel Series Products: www.nox-crete.com/#sle.
 - 3) Pittsburgh Paints; Perma-Crete Aqua-Pel Clear Water Repellent, 4-6100. (MPI #34): www.pittsburghpaintsco.com/#sle.
 - 4) PROSOCO, Inc; Sure Klean Weather Seal H40: www.prosoco.com/#sle.
 - 5) Sherwin-Williams Company; Loxon 7 Percent Siloxane, with VOC of Zero g/L: www.sherwin-williams.com/#sle.
 - 6) United Gilsonite Laboratories; DRYLOK Siloxane 7 Brick and Masonry Penetrating Sealer: www.ugl.com/#sle.
 - 7) W. R. Meadows, Inc; DECK-O-SHIELD: www.wrmeadows.com/#sle.
 - 8) Substitutions: See Section 01 60 00 - Product Requirements.
10. Water-based acrylic that reacts chemically with concrete and masonry.
 - a. Manufacturers:
 - 1) Pittsburgh Paints; Perma-Crete Plex-Seal WB Interior/Exterior Clear Sealer, 4-6200XI, Satin. (MPI #99): www.pittsburghpaintsco.com/#sle.
 - 2) Sherwin-Williams Company; H&C Concrete and Masonry Waterproofing Sealer, with VOC of 114 g/L or less: www.sherwin-williams.com/#sle.
 - 3) Substitutions: See Section 01 60 00 - Product Requirements.
11. Water-based acrylic that reacts chemically with untreated, natural wood surfaces.
 - a. Manufacturers:
 - 1) Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify joint sealants are installed and cured.

- C. Verify surfaces to be coated are dry, clean, and free of efflorescence, oil, or other matter detrimental to application of water repellent.

3.2 PREPARATION

- A. Protection of Adjacent Work:
 - 1. Protect adjacent landscaping, property, and vehicles from drips and overspray.
 - 2. Protect adjacent surfaces not intended to receive water repellent.
- B. Prepare surfaces to be coated as recommended by water repellent manufacturer for best results.
- C. Do not start work until masonry mortar substrate is cured a minimum of 60 days.
- D. Remove loose particles and foreign matter.
- E. Remove oil and foreign substances with a chemical solvent that will not affect water repellent.
- F. Scrub and rinse surfaces with water and let dry.
- G. Pressure wash surfaces to be coated.
 - 1. Concrete: Jet blast at 10,000 psi (68947.60 kPa), minimum.
 - 2. Concrete: Hydro blast at 4,000 to 10,000 psi (68947.60 kPa).
 - 3. Concrete: High pressure wash at 1,500 to 4,000 psi (27579.04 kPa), at 6 to 12 inches (150 to 300 mm) from surface.
 - 4. Firm Masonry (Concrete Masonry Units, Brick, and Dense Stone): High pressure wash at 1,500 to 4,000 psi (27579.04 kPa), at 6 to 12 inches (150 to 300 mm) from surface.
 - 5. Weathered Masonry (Brick and Stone): Pressure wash at 600 to 1,500 psi (10342.14 kPa) at 6 inches (152.4 mm) from surface.
 - 6. Soft Stone (Sandstone and Limestone): Power wash at 100 to 600 psi (4136.86 kPa) at 6 inches (152.4 mm) from surface.
- H. Acid etch smooth concrete surfaces to be coated, using procedures described in MPI (APSM); match approved mock-up.
- I. Allow surfaces to dry completely to degree recommended by water repellent manufacturer before starting coating work.

3.3 APPLICATION

- A. Apply water repellent in accordance with manufacturer's instructions, using procedures and application methods recommended as producing the best results.
- B. Apply at rate recommended by manufacturer, continuously over entire surface.
- C. Apply two coats, minimum.
- D. Remove water repellent from unintended surfaces immediately by a method instructed by water repellent manufacturer.
- E. Provide manufacturer's field service representative to inspect preparation and application work continuously during entire application period to ensure that manufacturer's "best practices" for preparation and application are being followed.

END OF SECTION

SECTION 07 54 23 - THERMOPLSTIC POLYOLEFIN (TOP) ROOFING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INLCUDES

- A. Provide labor, material, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
 - 1. Adhered thermoplastic polyolefin (TPO) roofing system.
 - 2. Rigid insulation system.

1.3 REFERENCE STANDARDS

- A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.
- B. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2023.
- C. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2023a.
- D. ASTM C1371 - Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers; 2015 (Reapproved 2022).
- E. ASTM C1549 - Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer; 2016 (Reapproved 2022).
- F. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2016 (Reapproved 2021).
- G. ASTM D471 - Standard Test Method for Rubber Property--Effect of Liquids; 2016a (Reapproved 2021).
- H. ASTM D751 - Standard Test Methods for Coated Fabrics; 2019.
- I. ASTM D1079 - Standard Terminology Relating to Roofing and Waterproofing; 2024.
- J. ASTM D1149 - Standard Test Methods for Rubber Deterioration-Cracking in an Ozone Controlled Environment; 2018 (Reapproved 2025).
- K. ASTM D1475 - Standard Test Method for Density of Liquid Coatings, Inks, and Related Products; 2025.
- L. ASTM E108 - Standard Test Methods for Fire Tests of Roof Coverings; 2020a.
- M. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2022.
- N. ASTM E1980 - Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces; 2011 (Reapproved 2019).
- O. ASTM G154 - Standard Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Nonmetallic Materials; 2023.
- P. ASTM G155 - Standard Practice for Operating Xenon Arc Lamp Apparatus for Exposure of Materials; 2025.
- Q. CRRC-1 - CRRC-1 Roof Product Rating Program Manual; 2025.
- R. ASTM D1204 - Standard Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheet or Film at Elevated Temperature.
- S. ASTM D-2137 - Standard Test Methods for Rubber Property—Brittleness Point of Flexible Polymers and Coated

- T. SPRI – Single-Ply Roofing Institute
- U. ANSI-SPRI ES-1 – Standard Field Test Procedure for Determining Withdrawing Resistance of Roofing Fasteners.
- V. TM E-96 – Standard Test Methods for Water Vapor Transmission of Materials.
- W. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) - Architectural Sheet Metal Manual.
- X. National Roofing Contractors Association (NRCA).
- Y. American Society of Civil Engineers (ASCE).
- Z. Factory Mutual (FM Global) – Approval Guide.
- AA. Underwriters Laboratories (UL) – Roofing Systems and Materials Guide (TGFU R1306).
- BB. ENERGY STAR.
- CC. Cool Roof Rating Council (CRRC).

1.4 REFERENCES:

- A. Refer to specification Section 01 41 00 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 DEFINITIONS

- A. Roofing Terminology: Definitions in ASTM D1079 and glossary in NRCA's "The NRCA Roofing and Waterproofing Manual" apply to work of this Section.

1.6 ACTION SUBMITTALS

- A. See Section 013000 – Administrative Requirements and Section 016000 – Product Requirements for submittal procedures.
- B. Product Data: For each type of product.
- C. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work, including:
 - 1. Base flashings and membrane terminations.
 - 2. Tapered insulation, including slopes.
 - 3. Roof plan showing orientation of roofing, fastening spacings, and patterns for mechanically fastened roofing.
 - 4. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
- D. Samples: Sheet roofing and walkway pads, of color required.
- E. Warranty: Submit sample warranty
- F. Safety Provisions:
 - 1. Submit a complete detailed schedule of special safety provisions implemented to insure the health and safety of the people.
 - 2. Work shall not start without the Owner's agreement of the following provisions:
 - a. A plan for a dust free operation;
 - b. A plan for the sequencing of work and the removal of debris from the site during and after construction.
 - c. A fall protection plan indicating the contractor plans for complying with OSHA's requirements.
- G. Approvals: Manufacturer shall submit documentation that product complies with and has been tested and approved in compliance with Florida Product Approval or Miami Dade NOA and applicable requirements.

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and manufacturer.

- B. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
 - 1. Submit evidence of compliance with performance requirements.
- C. Product Test Reports: For components of roofing system, tests performed by manufacturer and witnessed by a qualified testing agency.
- D. Provide sample warranties for review.

1.8 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roofing system to include in maintenance manuals.

1.9 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's warranty.
 - 1. Five (5) years minimum experience installing roofs for commercial/industrial/educational or similar buildings of same size and scope using products specified.
 - 2. Established office with experienced mechanics located within 100 miles (160.93 kilometers) radius of the project (does not apply to metal installers).
 - 3. Certified Florida roofing contractor.
 - 4. Must be certified as an applicator of the membrane or metal panel by the manufacturer prior to bidding. Sub-installers must also have the same certification.
 - 5. Must have installed products of specified manufacturers on at least five (5) previous jobs of similar size and scope.
 - 6. Must have a full-time roofing foreman or superintendent with a minimum of five (5) years documented experience installing products specified.
- B. Manufacturer Qualifications: A qualified manufacturer that has UL listing and FMG approval for roofing system identical to that used for this Project.
 - 1. Manufacturer shall have been in business as a membrane or a metal roof panel manufacturer for a minimum of ten (10) years making the generic product specified.
 - 2. Manufacturer shall have supplied same or equal products on at least five (5) projects of similar size and scope prior to bidding.
 - 3. Manufacturer shall furnish to the design professional prior to the prebid conference, written documentation to the above requirements.
- C. Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.
 - 1. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by membrane roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.
 - 2. Source Limitations: Obtain components including roof insulation, fasteners, for membrane roofing system from same manufacturer as membrane roofing or approved by membrane roofing manufacturer.
- D. Inspections
 - 1. The roof shall be inspected by the manufacturer's representative within one year of acceptance by the Owner in accordance with section 453.12.4, FBC, Building (SREF)
 - 2. Provide at a minimum one in progress inspection with the Manufacturer's Representative and the Owner's Representative. The Manufacturer's Representative shall submit a written report of the inspection results within ten (10) days after the inspection to the Architect.
 - 3. Inspections: Provide on-site weekly inspections by Owner's representative during and after installation of roofing system.

1.10 PREINSTALLATION MEETINGS

- A. The Contractor shall conduct a pre-installation meeting at the project site a minimum of 30 days prior to any work being installed as indicated in this section and other related sections that require coordination with this section.
- B. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
- C. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
- D. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
- E. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
- F. Review structural loading limitations of roof deck during and after roofing.
- G. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
- H. Review governing regulations and requirements for insurance and certificates if applicable.
- I. Review temporary protection requirements for roofing system during and after installation.
- J. Review roof observation and repair procedures after roofing installation.

1.11 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
- C. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- D. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- E. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

1.12 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.13 WARRANTY

- A. Provide Manufacturers standard Guarantee with single source coverage and no monetary limitation where the manufacturer agrees to repair or replace components in the roofing system, which cause a leak due to a failure in materials or workmanship.
 - 1. Duration: Twenty (20) years from the date of completion.
- B. Reflectivity Limited Warranty: Manufacture warrants to the original building owner, that the roof membrane will meet or exceed the initial and "aged" ENERGY STAR® reflectivity requirements for low slope roofing membranes (65% initial, 50% aged) when installed and maintained in accordance with manufacturers requirements. The aged reflectivity shall meet or exceed these

requirements when measured after cleaning the membrane in accordance with manufacturer's recommendations.

- C. Installer Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering the Work of this Section, including all components of roofing system such as roofing, base flashing, roof insulation, fasteners, cover boards, vapor retarders, roof pavers, and walkway products, for the following warranty period:
 - 1. Warranty Period: Two (2) years from date of Substantial Completion.

1.14 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roofing and base flashings shall remain watertight.
 - 1. Accelerated Weathering: Roofing system shall withstand 2000 hours of exposure when tested according to ASTM G 152, ASTM G154, or ASTM G155.
- B. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.
- C. Provide an installed roofing membrane and base flashing system that does not permit the passage of water and will withstand the design pressures calculated in accordance with the most current revision of ASCE 7.
- D. Manufacturer shall provide all primary roofing materials that are physically and chemically compatible when installed in accordance with manufacturers' current application requirements.
- E. Roofing System Design: Tested by a qualified testing agency to resist the following uplift pressures:
 - 1. Uplift Pressures: As indicated on structural plans.
- F. Energy Star Listing: Roofing system shall be listed on the DOE's ENERGY STAR "Roof Products Qualified Product List" for low-slope roof products.
- G. Insulation, moisture protection, roofing, thermal requirements, fireproofing and firestopping shall be design and constructed in compliance with the Florida Building Code and Florida Fire prevention Code as adopted by the State Fire marshal.
- H. Exterior Fire-Test Exposure: Roof shall comply with FBC 453.12 per ASTM E108, Class A; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. All roofing materials shall be labeled Class A per ASTM E108 and shall be certified by a nationally recognized independent testing laboratory. All roofing systems shall be installed within the limitations of the test procedure for surfacing, deck cross slope, and combustibility.
- I. Exterior Fire-Test Exposure: ASTM E108, Class A; for application and roof slopes indicated, as determined by testing identical membrane roofing materials by a qualified testing agency. Materials shall be identified with appropriate markings of applicable testing agency.
- J. Fire-Resistance Ratings: Provide fire-resistance-rated roof assemblies identical to those of assemblies tested for fire resistance per ASTM E119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- K. FM Approvals Listing: Provide membrane roofing, base flashings, and component materials that comply with requirements in FM Approvals 4450 and FM Approvals 4470 as part of a membrane roofing system, and that are listed in FM Approvals' "RoofNav" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals markings.
 - 1. Fire/Windstorm Classification: Class 1A-90.

- L. Fire-Test-Response Characteristics: Provide roofing materials with the fire-test-response characteristics indicated as determined by testing identical products per test method below by UL, FMG, or another testing and inspecting agency acceptable to authorities having jurisdiction. Materials shall be identified with appropriate markings of applicable testing and inspecting agency.
- M. Per FBC 453.12.3 phased installation is prohibited. All new installed materials shall be sealed from moisture penetration at the end of each day. The contractor shall provide the Architect/Engineer (A/E) of record a "final statement of compliance" for the board.
- N. Approvals: Manufacturer shall certify that product complies with and has been tested and approved in compliance with Florida Product Approval or Miami Dade NOA and applicable requirements.

PART 2 PRODUCTS

2.1 MANUFACTURERS:

- A. The manufacturer and basis of design shall be the following however products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product:
 - 1. Holcim Solutions and Products US, LLC
- B. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities described in the specification.
 - 1. GAF Materials Corporation
 - 2. Carlisle SynTec Incorporated
 - 3. Johns Manville
 - 4. Versico Roofing Systems
- C. Other manufacturers must have a minimum of five (5) years' experience manufacturing products meeting or exceeding the specifications and comply with Section 01 60 00 requirements regarding substitutions to be considered including acceptance is provided by the Architect in writing prior to bidding.

2.2 TPO ROOFING

- A. Basis of Design: "Elevate UltraPly TPO Roof Systems"
 - 1. Florida Product Approval: #FL-10264.1 - R19
- B. System: Polyester scrim reinforced thermoplastic polyolefin membrane for use as a single ply roof membrane complying with ASTM D6878.
- C. TPO Sheet:
 - 1. Thickness: 60 mils (1.524 mm), nominal.
 - 2. Exposed Face Color: White.
- D. Solar Reflectance Index: Not less than an initial index of not less than 95 and an aged index of not less than 85 when calculated according to ASTM E1980, based on testing identical products by a qualified testing agency.
- E. Energy Performance: Roofing system shall have an initial solar reflectance of not less than 0.77 and an emissivity of not less than 0.87 when tested according to CRRC-1.

2.3 AUXILIARY ROOFING MATERIALS

- A. The following items shall be the standards of membrane roofing manufacturer.
- B. Solvent-based Bonding Adhesive: Solvent based rubberized adhesive for use with TPO membranes.
- C. Edge Sealer: Solvent based liquid, required to protect filed cut edges of TPO membranes.
- D. Primer: Solvent based primer for preparing surfaces to receive butyl based adhesive tapes.

- E. Cleaner: Solvent based seam cleaner used to clean exposed or contaminated seam prior to heat welding.
- F. Sealant: Solvent based, trowel grade synthetic elastomeric sealant. Durable and UV resistant suitable for use where caulk is typically used.
- G. Termination Bar Sealant: Commercial grade roofing sealant suitable for sealing the upper lip of exposed termination bars and penetrations and around clamping rings. Meets the performance criteria of ASTM D412, ASTM D2196, ASTM D2196, ASTM D1475 and ASTM D1644.
- H. Adhesive Tape Primer: Low VOC solvent-based primer for preparing surfaces to receive butyl based adhesive tapes.
- I. Heat Welding Cleaner: Low VOC TPO cleaner designed to clean exposed or contaminated seams prior to heat welding to remove any residual soap or revitalize aged membranes.
- J. Flashing Sealer: One-part butyl based high viscosity sealant suitable for sealing between flashing membrane and substrate surface behind exposed termination bars and for sealing between roofing membrane and drain flange.
- K. Filler: 100% solids epoxy based two-part sealant suitable for filling sealant pans at irregularly-shaped penetrations. Epoxy is part A Polyamide is part B.
- L. Self-Leveling Sealant: One-part, moisture-cure, self-leveling sealant designed for use in pitch pans on single ply roof systems.

2.4 FASTENERS

- A. The following items shall be the standards of membrane roofing manufacturer.
- B. Standard Screws: Standard duty alloy steel insulation fastener with CR-10 coating with a .215" diameter thread. Factory Mutual Standard 4470 Approved, #3 Phillips head for use on steel and wood decks.
- C. Insulation Plates: Manufacturer's standard plate galvalume, suitable for use with Standard and HD screws, and Spikes.

2.5 FLASHING ACCESSORIES

- A. Penetration Flashing: Unreinforced thermoplastic polyolefin based smooth membrane for use as an alternative flashing/reinforcing material for penetrations and corners. Required whenever preformed vent boots cannot be used, white in color.
- B. Cover Strip: 8 inch (203.2 mm) wide smooth type, polyester scrim reinforced thermoplastic polyolefin membrane strip for use as a cover strip over coated metal and stripping-in coated metal flanges and general repairs: 0.045 inches (1.14 mm) nominal thickness with 100 foot (3048 cm) length.
- C. Termination Bar: Extruded aluminum termination bar with angled lip caulk receiver and lower leg bulb stiffener. Pre-punched slotted holes at 6" on center or 8" on center. 3/4" x 10' with 0.090" cross section.
- D. Base Adhesive: .045" reinforced TPO membrane with pressure sensitive adhesive, to be installed on horizontal surfaces using plates and fasteners as a base attachment in fully adhered systems. Size 6" x 100'.
- E. Miscellaneous Metal: 24-gauge steel with 0.025" thick TPO based film as required for fabrication into metal gravel stop and drip edge profiles, metal base and curb flashings, sealant pans, and scupper sleeves. Standard sheet size 4' x 10'.
- F. Metal Roof Edging and Fascia: Continuous metal edge member serving as termination of roof membrane. Watertight with no exposed fasteners; mounted to roof edge nailer.
 - 1. Wind Performance:
 - a. Membrane Pull-Off Resistance: 100 lbs./ft. minimum, when tested in accordance with ANSI/SPRI ES-1 Test Method RE-1.

- b. Fascia Pull-Off Resistance: At least the minimum required when tested in accordance with ANSI/SPRI ES-1 Test Method RE-2.

2.6 RIGID INSULATION BOARD

- A. Manufacturer: Elevate. Product: ISOGARD GL polyiso board insulation.
- B. General: Preformed flat and tapered roof insulation boards manufactured or approved by roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated.
- C. Polyisocyanurate Board Insulation: ASTM C1289, Type II, Class 1, Grade 2, glass-fiber mat facer on both major surfaces.
- D. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch (6.35 mm) per 12 inches (304.8 mm) unless otherwise indicated.
- E. Cover Board Joint Tape: 6- or 8-inch wide, coated, glass-fiber joint tape
- F. R-Value: 5.7 per inch
- G. Roof R-Value: R-value shall be a minimum 30 and as indicated on the drawings.

2.7 COVER BOARD

- A. Manufactures: The basis of design products "Securerock" are manufactured by USG. Equal or better performing products of other manufacturers will be considered for acceptance by the Architect
- B. Fiberglass-Mat Faced Cover Board: Comply with ASTM C1177/1177M, Type X. Class A.
 - 1. Thickness: 5/8 inch (15.88 mm).
 - 2. Width: 4 feet (121.92 cm).
 - 3. Length: 8 feet (243.84 cm).
 - 4. Edges: Square.
 - 5. Surfacing: Fiberglass mat on face, back and long edges.

2.8 PENETRATION ACCESSORIES

- A. Pipe and Conduit Flashing: 0.075" thick molded membrane sized to accommodate most pipe and conduits, (1" to 6" diameter pipes), including square tube. Hot-air welded directly to TPO membrane, supplied with stainless steel clamping rings.
- B. Split Pipe and Conduit Flashing: 0.045" thick molded TPO membrane performed boots are split to accommodate common pipes and conduits and available in three sizes.

2.9 FIELD OF ROOF ACCESSORIES

- A. Expansion Joint Covers: Pre-manufactured expansion joint covers used to bridge expansion joint openings. Fabricated to accommodate all roof to wall and roof to roof applications.
- B. Walkway Roll: Roofing manufacturer's standard TPO walkway, 125 mil (3.17501 mm) extruded and embossed TPO in a gray color.
- C. Splash Pads: Provide and install precast concrete type, of sizes and profiles indicated; minimum 3000 psi (20684.28 kPa) at 28 days, with minimum 5% air entrainment.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that the surfaces and site conditions are ready to receive work.
- B. Verify that the deck is supported and secured.
- C. Verify that the deck is clean and smooth, free of depressions, waves, or projections, and properly sloped to drains, valleys, eaves, scuppers, or gutters.
- D. Verify that the deck surfaces are dry.

- E. Verify that all roof openings or penetrations through the roof are solidly set, and that all flashings are tapered.
- F. Substrate Acceptance: With the general contractor present, examine surfaces to receive the roof insulation system and determine that the surfaces are acceptable prior to placement of the insulating system.

3.2 PREPARATION

- A. General: Remove water or any other substance that would interfere with roof system installation.

3.3 RIGID INSULATION INSTALLATION

- A. Do not apply roof insulation or roofing until all other work trades have completed jobs that require them to traverse the deck on foot or with equipment. A vapor retarder coated lightly with asphalt may be applied to protect the inside of the structure prior to the insulation and final roofing installation. Before the application of the insulation, any damage or deterioration to the vapor retarder must be repaired.
- B. Do not install wet, damaged, or warped insulation boards.
- C. Install insulation boards with staggered board joints in one direction (unless taping joint).
- D. Install insulation boards snug. Gaps between board joints must not exceed 1/4". All gaps in excess of 1/4" must be filled with like insulation material.
- E. Wood nailers must be 3-1/2" minimum width or 1" wider than metal flange. They shall be of equal thickness as the insulation and be treated for rot resistance. All nailers must be securely fastened to the deck.
- F. Do not kick insulation boards into place.
- G. Miter and fill the edges of the insulation boards at ridges, valleys, and other changes in plane to prevent open joints or irregular surfaces. Avoid breaking or crushing of the insulation at the corners.
- H. Roof tape, if required over insulation joints, must be laid evenly, smoothly, and embedded in a uniform coating of hot steep asphalt with 4" end laps. Care must be taken to assure smooth application of tape, and full embedment of the tape in the asphalt.
- I. Do not install any more insulation than will be completely waterproofed each day.
- J. The insulation must be securely attached to the roof deck using fastener.
- K. Use only fasteners as indicated in the Performance Requirements.

3.4 COVER BOARD INSTALLATION

- A. Coordinate installing membrane roofing system components so cover board is not exposed to precipitation or left exposed at the end of the workday.
- B. Comply with membrane roofing system manufacturer's written instructions for installing roof cover board.
- C. Install cover board with long joints of cover board in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch (6.35 mm) with cover board.
 - 1. Cut and fit cover board within 1/4 inch (6.35 mm) of nailers, projections, and penetrations.
- D. Trim surface of cover board where necessary at roof drains so completed surface is flush and does not restrict flow of water.
 - 1. Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.
- E. Install cover board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.

1. Fasten cover board to top flanges of steel deck according to recommendations in FM Global's "RoofNav" and FM Global Loss Prevention Data Sheet 1-29 for specified Windstorm Resistance Classification.
2. Fasten cover board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof according to roofing system manufacturers' written instruction.

3.5 INSTALLATION – GENERAL

- A. Install TPO roofing system according to all current application requirements in addition to those listed in this section.
- B. Start the application of membrane plies at the low point of the roof or at the drains, so that the flow of water is over or parallel to, but never against the laps.

3.6 MEMBRANE APPLICATION

- A. Fully Adhered:
 1. Place membrane so that wrinkles and buckles are not formed. Any wrinkles or buckles must be removed from the sheet prior to permanent attachment. Roof membrane shall be fully adhered immediately after it is rolled out, followed by welding to adjacent sheets.
 2. Overlap roof membrane a minimum of 3" for side laps and 3" for end laps.
 3. Install membrane so that the side laps run across the roof slope lapped towards drainage points.
 4. All exposed sheet corners shall be rounded a minimum of 1".
 5. Use full width rolls in the field and perimeter region of roof.
 6. Use appropriate bonding adhesive for substrate surface, applied with a solvent-resistant roller, brush, or squeegee.
 7. Apply bonding adhesive at 1.2 to 1.67 gal/sq/surface. A greater quantity of bonding adhesive may be required based upon the substrate surface condition.
 8. Prevent seam contamination by keeping the adhesive application a few inches back from the seam area.
 9. Adhere approximately one half of the membrane sheet at a time. One half of the sheet's length shall be folded back in turn to allow for adhesive application. Lay membrane into adhesive once the bonding adhesive is tacky to the touch.
 10. Roll membrane with a weighted roller to ensure complete bonding between adhesive and membrane.
 11. Membrane laps shall be heat-welded together. All welds shall be continuous, without voids or partial welds. Welds shall be free of burns and scorch marks.
 12. Weld shall be a minimum of 1-1/2" in width for automatic machine welding and a minimum 2" in width for hand welding.
 13. All cut edges of reinforced membrane must be sealed with TPO Cut Edge Sealant.
 14. Supplemental membrane attachment is required at the base of all walls and curbs, and where the angle of the substrate changes by more than five (5) degrees (1" in 12"). Roofing membrane shall be secured to the structural deck with appropriate Drill-Tec™ screws and plates spaced every 12" o.c. The screws and plates must be installed no less than 1/2" from the membrane edge. Alternatively, the roofing membrane may be turned up the vertical plane a minimum of 3" and secured with screws and termination bar. Fastener spacing is the same as is used for in-lap attachment. The termination bar must be installed within 1-1/2" to 2" of the plane of the roof membrane, with a minimum of 1" of membrane extending above the termination bar.
 15. Supplemental membrane attachment to the structural deck is required at all penetrations unless the insulation substrate is fully adhered to the deck. Roofing membrane shall be secured to the deck with appropriate screws and plates.
 16. Fasteners must be installed to achieve the proper embedment depth. Install fasteners without lean or tilt.

17. Install fasteners so that the plate or termination bar is drawn down tightly to the membrane surface. Properly installed fasteners will not allow the plate or termination bar to move (underdriving), but will not cause wrinkling of the membrane (overdriving).

B. FLASHINGS

C. General

1. All penetrations must be at least 24" from curbs, walls, and edges to provide adequate space for proper flashing.
2. Flash all perimeter, curb, and penetration conditions with coated metal, membrane flashing, and flashing accessories as appropriate to the site condition.
3. All coated metal and membrane flashing corners shall be reinforced with preformed corners or non-reinforced membrane.
4. Hot-air weld all flashing membranes, accessories, and coated metal. A minimum 2" wide hand weld or minimum 1-1/2" automatic machine weld is required
5. All cut edges of reinforced membrane must be sealed with TPO Cut Edge Sealant.

D. Reinforced Membrane Flashings

1. The thickness of the flashing membrane shall be the same as the thickness of the roofing membrane.
2. Membrane flashing may either be installed loose or fully adhered to the substrate surface in accordance with "Construction Detail Requirements".
3. Where flashings are to be fully adhered, apply bonding adhesive at a rate resulting in 60 sq feet (0.06459 sq cm)/gallon of finished roofing material for solvent-based bonding adhesives, and at a rate of 125 sq feet (0.13455 sq cm)/gallon of finished roofing material for water-borne bonding adhesive. Apply bonding adhesive to both the underside of the membrane and the substrate surface at 120 sq feet (0.12917 sq cm) per gallon (Solvent Based) and 250 sq feet (0.26911 sq cm) per gallon (Water Based). A greater quantity of bonding adhesive may be required based upon the substrate surface condition. The bonding adhesive must be allowed to dry until tacky to the touch before flashing membrane application.
4. Apply the adhesive only when outside temperature is above 40°F. Recommended minimum application temperature is 50°F to allow for easier adhesive application.
5. The membrane flashing shall be carefully positioned prior to application to avoid wrinkles and buckles.

E. Un-Reinforced Membrane Flashings

1. Un-reinforced membrane is used to field-fabricate penetration or reinforcement flashings in locations where preformed corners and pipe boots cannot be properly installed.
2. Penetration flashings constructed of un-reinforced membrane are typically installed in two sections, a horizontal piece that extends onto the roofing membrane and a vertical piece that extends up the penetration. The two pieces are overlapped and hot-air welded together.
3. The un-reinforced membrane flashing shall be adhered to the penetration surface. Apply bonding adhesive at a rate resulting in 60 sq feet (0.06459 sq cm)/gallon of finished roofing material for solvent-based bonding adhesives, and at a rate of 125 sq feet (0.13455 sq cm)/gallon of finished roofing material for water-borne bonding adhesive. Apply bonding adhesive to both the underside of the membrane and the substrate surface at 120 sq feet (0.12917 sq cm) per gallon (Solvent Based) and 250 sq feet (0.26911 sq cm) per gallon (Water Based). A greater quantity of bonding adhesive may be required based upon the substrate surface condition. The bonding adhesive must be allowed to dry until tacky to the touch before flashing membrane application.

3.7 ROOF EDGES

- A. Roof edge flashings are applicable for exterior edges of parapet walls.

- B. Flash roof edges with coated metal flanged edging with a minimum 3" wide flange nailed 4" on center to wood nailers, and heat weld roof membrane to metal flanges.
- C. When the fascia width exceeds 4", coated metal roof edging must be attached with a continuous cleat to secure the lower fascia edge. The cleat must be secured to the building no less than 12" o.c.
- D. Flash roof edge scuppers with a coated metal insert that is mechanically attached to the roof edge and integrated as a part of the metal edging.
- E. Alternatively, roof edges may be flashed with a 2-piece snap on fascia system, adhering the roof membrane to a metal cant and face nailing the membrane 8" on center prior to installing a snap-on fascia.
- F. Parapet and Building Walls
 - 1. Flash walls with TPO membrane adhered to the substrate with bonding adhesive, loose applied (Less than 24" in height) or with coated metal flashing nailed 4" on center to pressure-treated wood nailers.
 - 2. Secure membrane flashing at the top edge with a termination bar. Water Block shall be applied between the wall surface and membrane flashing underneath all exposed termination bars. Exposed termination bars shall be mechanically fastened 8" on center; termination bars that are counter flashed shall be fastened 12" on center.
 - 3. Roof membrane must be mechanically attached along the base of walls with screws and plates (deck securement) or screws and inverted termination bar (wall securement) at the following rate:
 - a. Fully / Self Adhered System: 12" on center
 - 4. All coated metal wall flashings and loose applied membrane flashings must be provided with separate metal counterflashings, or metal copings.
 - 5. Metal counterflashings may be optional with fully adhered flashings depending on guarantee requirements. Exposed termination bars must be sealed with Flexseal® Roofing Cement or Flexseal® Caulk Grade.
 - 6. Flash wall scuppers with a coated metal insert that is mechanically attached to the wall and integrated as part of the wall flashing.
- G. Curbs and Ducts
 - 1. Flash curbs and ducts with membrane adhered to the curb substrate with bonding adhesive, loose applied (Less than 18" in height) or with coated metal flashing nailed 4" on center to pressure-treated wood nailers.
 - 2. Secure membrane flashing at the top edge with a termination bar. Water Block shall be applied between the curb/duct surface and membrane flashing underneath all termination bars. Exposed termination bars shall be mechanically fastened every 8" o.c.; termination bars that are counter flashed shall be fastened 12" on center.
 - 3. Roof membrane must be mechanically attached along the base of walls with screws and plates (deck securement) or screws and inverted termination bar (wall securement) at the following rate:
 - a. Fully / Self Adhered System: As indicated per the Performance Requirements
- H. Roof Drains
 - 1. Roof drains must be fitted with compression type clamping rings and strainer baskets. Original-type cast iron and aluminum drains, as well as retrofit-type cast iron, aluminum or molded plastic drains are acceptable.
 - 2. Roof drains must be provided with a minimum 36" x 36" sump if applicable. Slope of tapered insulation within the sump shall not exceed 4" in 12".
 - 3. Extend the roofing membrane over the drain opening. Locate the drain and cut a hole in the roofing membrane directly over the drain opening. Provide a 1/2" of membrane flap extending past the drain flange into the drain opening. Punch holes through the roofing membrane at drain bolt locations.

4. For cast iron and aluminum drains, the roofing membrane must be set in a full bed of water block on the drain flange prior to securement with the compression clamping ring. Typical water block application is one 10.5 ounce cartridge per drain.
5. Lap seams shall not be located within the sump area. Where lap seams will be located within the sump area, a separate roof membrane drain flashing a minimum of 12" larger than the sump area must be installed. The roof membrane shall be mechanically attached 12" on center around the drain with screws and plates. The separate roof drain flashing shall be heat welded to the roof membrane beyond the screws and plates, extended over the drain flange, and secured as above.
6. Tighten the drain compression ring in place.

3.8 TRAFFIC PROTECTION

- A. Install walkway rolls at all roof access locations and other designated locations including roof-mounted equipment work locations and areas of repeated rooftop traffic.
- B. Walkway pads must be provided between roof access and each piece of rooftop equipment. Provide a double roll to provide a 5' - 0" wide walkway pad around and on all sides of rooftop equipment.
- C. Heat-weld walkway rolls to the roof membrane surface continuously around the perimeter of the roll.
- D. Walkway rolls may be installed with TPO primer and 3" seam tape.
 1. Roll or brush the TPO primer on the back of the TPO pad along the edges and down the middle length of the pad.
 2. Clean and prime the roof membrane where the pad will be installed.
 3. Install tape to the back of the cleaned area of the pad and roll in with a silicone hand roller.
 4. Remove release paper and install the tapes pads directly onto the roof membrane. Roll pads to secure in place.

3.9 SPLASH PAD INSTALLATION

- A. Splash Pads Installation: Provide splash pads at locations where downspouts discharge onto the roofing membrane. Provide a 2'-0" wide by 10'-0" long splash apron under the splash pad. Splash apron shall be an addition piece of cap sheet adhered to the roofing surface.

3.10 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Provide periodic inspections of roof application by qualified technical representative of roofing manufacturer

3.11 ROOF TESTING

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections and to prepare test reports.
- B. Test Cuts: Test specimens will be removed to evaluate problems observed during quality-assurance inspections of roofing membrane as follows:
 1. Approximate quantities of components within roofing membrane will be determined according to ASTM D 3617.
 2. Test specimens will be examined for interply voids according to ASTM D 3617 and to comply with criteria established in Appendix 3 inch (76.2 mm) ARMA/NRCA's "Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing."
 3. Repair areas where test cuts were made according to roofing system manufacturer's written instructions.
- C. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.
 1. Notify Architect and Owner 48 hours in advance of date and time of inspection.
- D. Roofing system will be considered defective if it does not pass tests and inspections.

1. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

3.12 CLEANING

- A. Clean up debris, excess materials, and equipment and remove from site.
- B. Remove bitumen from surfaces other than those requiring bituminous roof coatings.
- C. Remove bituminous markings from finished surfaces.
- D. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

3.13 PROTECTION

- A. Provide special protection or avoid heavy traffic on completed work when ambient temperature is above 80°F.
- B. Restore to original condition or replace work or materials damaged during handling of bitumen and roofing materials.
- C. Do not transverse any walkways where new work has been completed where traffic must continue over finished roof membrane, protect surfaces.
- D. Do not throw or drop debris from roof, use chutes, or high lift trucks.
- E. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.
- F. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

3.14 ROOFING INSTALLER'S WARRANTY

- A. WHEREAS _____ of _____, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:
 1. Owner: .
 2. Address: .
 3. Building Name/Type: .
 4. Address: .
 5. Area of Work: .
 6. Acceptance Date: _____.
 7. Warranty Period: Two Years.
 8. Expiration Date: _____.
- B. subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,
- C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.
- D. This Warranty is made subject to the following terms and conditions:
 1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:
 - a. lightning;
 - b. Insert required wind speed in first subparagraph below.
 - c. peak gust wind speed exceeding ;
 - d. fire;

- e. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
 - f. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
 - g. vapor condensation on bottom of roofing; and
 - h. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.
2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
3. 3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
5. During Warranty Period, if original use of 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 or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.
6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.
 - a. WITNESS THEREOF, this instrument has been duly executed this _____
 - b. day of _____, _____.
 - c. Authorized Signature:
 - d. _____.
 - e. Name: _____.
 - f. Title: _____.

END OF SECTION

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SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specification and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

- A. Fabricated sheet metal items, including flashings, counterflashings, gutters, downspouts, exterior penetrations, and copings..
- B. Sealants for joints within sheet metal fabrications.

1.3 REFERENCE STANDARDS

- A. AAMA 611 - Specification for Anodized Architectural Aluminum; 2024.
- B. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.
- C. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.
- D. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; Revision 21A, December 1, 2021.
- E. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.
- F. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2018).
- G. CDA A4050 - Copper in Architecture - Handbook; Current Edition.
- H. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.4 REFERENCES

- A. Refer to specification Section 01 41 00 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene one week before starting work of this section.

1.6 ACTION SUBMITTALS

- A. See Section 01 30 00 – Administrative Requirements and Section 01 60 00 – Product Requirements for submittal procedures.
- B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.
- C. Samples: Submit two samples, 6 by 6 inches in size, illustrating metal finish color.

1.7 QUALITY ASSURANCE

- A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.
- B. Fabricator and Installer Qualifications: Company specializing in sheet metal work with 5 years of documented experience.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. See Section 017419 - Construction Waste Management and Disposal for packaging waste requirements.

- B. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- C. Prevent contact with materials that could cause discoloration or staining.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Sheet Metal Flashing and Trim:
 - 1. Hickman Edge Systems: www.hickmanedgesystems.com/#sle.
 - 2. Petersen Aluminum Corporation: www.pac-clad.com/#sle.
 - 3. Taylor Metal Products: www.taylormetal.com/#sle.
 - 4. Substitutions: See Section 016000 - Product Requirements for substitution procedures.

2.2 SHEET MATERIALS

- A. Anodized Aluminum: ASTM B209/B209M, 3005 alloy, H12 or H14 temper; 0.032 inch (0.81 mm) thick; clear anodized finish.
 - 1. Clear Anodized Finish: AAMA 611, AA-M12C22A41, Class I, clear anodic coating not less than 0.7 mil (0.01778 mm), 0.0007 inch (0.02 mm) thick.
 - 2. Color Anodized Finish: AAMA 611, AA-M12C22A42/44, Class I, integrally or electrolytically colored anodic coating not less than 0.7 mil (0.01778 mm), 0.0007 inch (0.02 mm) thick.
 - a. Color: As selected by Architect from manufacturer's standard colors.
- B. Stainless Steel: ASTM A666/A666M, Type 304 alloy, soft temper, 28 gauge, 0.0156 inch (0.4 mm) thick; smooth No. 4 - Brushed finish.

2.3 PREFINISHED ALUMINUM SHEETS

- A. Aluminum Sheet Substrates: ASTM B209/B209M, alloy and temper as recommended by manufacturer for application.

2.4 GUTTERS AND DOWNSPOUTS

- A. Seal metal joints.

2.5 FLASHING

- A. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for conduits and facade materials to be installed.

2.6 ACCESSORIES

- A. Fasteners: Galvanized steel, with soft neoprene washers.
- B. Primer Type: Zinc chromate.
- C. Concealed Sealants: Non-curing butyl sealant.
- D. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.
- E. Asphalt Roof Cement: ASTM D4586/D4586M, Type I, asbestos-free.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.
- B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.2 INSTALLATION

- A. Secure flashings in place using concealed fasteners and use exposed fasteners only where permitted.

- B. Apply plastic cement compound between metal flashings and felt flashings.
- C. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- D. Secure gutters and downspouts in place with concealed fasteners.

3.3 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements for field inspection requirements.
- B. Inspection will involve surveillance of work during installation to ascertain compliance with specified requirements.

END OF SECTION

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SECTION 07 72 00 - ROOF ACCESSORIES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications and the Sections included under Division 1, General Requirements and References are included as part of this Section as though bound herein.

1.2 SECTION INCLUDES

- A. Roof curbs.
- B. Roof hatches.
- C. Non-penetrating pedestals.

1.3 REFERENCE STANDARDS

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- B. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.
- C. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings; 2020.
- D. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.
- E. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
- F. ASTM C726 - Standard Specification for Mineral Wool Roof Insulation Board; 2017.
- G. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2023a.

1.4 REFERENCES

- A. Refer to specification Section 014100 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 COORDINATION

- A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.
- B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

1.6 ACTION SUBMITTALS

- A. See Section 013000 – Administrative Requirements and Section 016000 – Product Requirements for submittal procedures.
- B. Product Data: For each type of roof accessory.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- C. Shop Drawings: For roof accessories.
 - 1. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled work.
- D. Samples: For each exposed product and for each color and texture specified, prepared on Samples of size to adequately show color.

1.7 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Roof plans, drawn to scale, and coordinating penetrations and roof-mounted items. Show the following:
 - 1. Size and location of roof accessories specified in this Section.
 - 2. Method of attaching roof accessories to roof or building structure.
 - 3. Other roof-mounted items including mechanical and electrical equipment, ductwork, piping, and conduit.
 - 4. Required clearances.
- B. Sample Warranties: For manufacturer's special warranties.

1.8 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For roof accessories to be included in operation and maintenance manuals.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Roof accessories shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

2.2 MANUFACTURERS

- A. Roof Hatch: The manufacturer and basis of design shall be the following however products of other manufacturers listed will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product.
 - 1. Babcock-Davis, www.babcockdavis.com/#sle.
- B. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product:
 - 1. Babcock-Davis, www.babcockdavis.com/#sle.
 - 2. Bilco Company, www.bilco.com/#sle.
 - 3. Milcor by Duravent
 - 4. Elmdor: www.elmdor.com/#sle.
 - 5. Nystrom, Inc: www.nystrom.com/#sle.
- C.

2.3 ROOF HAT

- A. Roof Hatches: Metal roof-hatch units with lids and insulated double-walled curbs, welded or mechanically fastened and sealed corner joints, continuous lid-to-curb counterflashing and weathertight perimeter gasketing, straight sides, and integrally formed deck-mounting flange at perimeter bottom.
- B. Type and Size: Single-leaf lid, 36 by 36 inches (914 by 914 mm).
- C. Loads: Minimum 40-lbf/sq. ft. (1.9-kPa) external live load and 20-lbf/sq. ft. (0.95-kPa) internal uplift load.
- D. Hatch Material: Aluminum sheet.
 - 1. Thickness: Minimum 11 gauge (0.09 inch).
 - 2. Finish: Mill.
- E. Construction:
 - 1. Insulation: Glass-fiber board or polyisocyanurate board.
 - 2. Hatch Lid: Opaque, insulated, and double walled, with manufacturer's standard metal liner of same material and finish as outer metal lid.
 - 3. Curb Liner: Manufacturer's standard, of same material and finish as metal curb.

4. Fabricate curbs to a minimum height of 12 inches (305 mm) above the roofing surface unless otherwise indicated.
- F. Hardware: Lift assist, spring operators, hold-open arm, stainless-steel spring latch with turn handles, stainless-steel butt- or pintle-type hinge system, and padlock hasps inside and outside.
- G. Ladder-Assist Post: Roof-hatch manufacturer's standard device for attachment to roof-access ladder.
 1. Operation: Post locks in place on full extension; release mechanism returns post to closed position.
 2. Height: 42 inches (1060 mm) above finished roof deck.
 3. Material: Steel tube.
 4. Post: 1-5/8-inch- (41-mm-) diameter pipe.
 5. Finish: Manufacturer's standard baked enamel or powder coat.

2.4 METAL MATERIALS

- A. Non-Penetrating Pedestals: Steel pedestals with square, round, or rectangular bases.
 1. Bases: High density polypropylene.
 2. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
 3. Steel Components: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.

2.5 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for complete installation.
- B. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.

2.6 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.
- B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
- C. Verify dimensions of roof openings for roof accessories.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install roof accessories according to manufacturer's written instructions.
 1. Install roof accessories level; plumb; true to line and elevation; and without warping, jogs in alignment, buckling, or tool marks.
 2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
 3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
 4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.

- B. Roof-Hatch Installation:
 - 1. Verify that the roof hatch operates properly. Clean, lubricate, and adjust operating mechanism and hardware.
 - 2. Attach ladder-assist post according to manufacturer's written instructions.

3.3 REPAIR AND CLEANING

- A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A780/A780M.
- B. Clean exposed surfaces according to manufacturer's written instructions.
- C. Clean off excess sealants.
- D. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 077200

SECTION 07 84 00 - FIRESTOPPING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

- A. Firestopping systems.

1.3 REFERENCE STANDARDS

- A. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
- B. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2022.
- C. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2023a.
- D. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems; 2015 (Reapproved 2019).
- E. ASTM E2174 - Standard Practice for On-Site Inspection of Installed Firestop Systems; 2020a.
- F. ASTM E2393 - Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers; 2020a.
- G. ITS (DIR) - Directory of Listed Products; Current Edition.
- H. FM (AG) - FM Approval Guide; Current Edition.
- I. UL 1479 - Standard for Fire Tests of Penetration Firestops; Current Edition, Including All Revisions.
- J. UL (FRD) - Fire Resistance Directory; Current Edition.

1.4 REFERENCES:

- A. Refer to specification Section 014100 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 ACTION SUBMITTALS

- A. See Section 013000 – Administrative Requirements and Section 016000 – Product Requirements for submittal procedures.
- B. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.
- C. Product Data: Provide data on product characteristics, performance ratings, and limitations.
- D. Shop Drawings:
 - 1. Submit shop drawings showing layout, profiles, and product components.
 - 2. Include Independent laboratory with system classification number on shop drawings.
- E. Certification from sealant manufacturers that their products are suitable for the use indicated and comply with specification requirements.
- F. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.
- G. Certificate from authority having jurisdiction indicating approval of materials used.
- H. Manufacturer's qualification statement.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

- B. Installer Certificates: From Installer indicating penetration firestopping has been installed in compliance with requirements and manufacturer's written recommendations.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of penetration firestopping.

1.7 QUALITY ASSURANCE

- A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Installer Qualifications: Company specializing in performing the work of this section and:
 - 1. A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."
- D. Applicator Qualifications:
 - 1. Applicator shall have at least 3-years experience in installing materials of types specified and shall have successfully completed at least 3-projects of similar scope and complexity.
 - 2. Manufacturer approved applicator.
 - 3. Applicator shall designate a single individual as project supervisor who shall be on site at all times during installation.
- E. Single source responsibility for firestopping materials:
 - 1. Obtain Firestop materials from single manufacturer for each different product required.
 - 2. Manufacturer shall instruct applicator in procedures for each material.
- F. Regulatory Requirements:
 - 1. Firestop System installation shall meet requirements of ASTM E-814 and provide a fire rating equal to that of the construction it penetrates.
 - 2. Proposed Firestop materials and methods shall conform to applicable governing codes having local jurisdiction.
 - 3. For those Firestop applications not having an UL or third party tested system available through any manufacturer.
 - a. Prior to installation the manufacturer may submit to the authorities having jurisdiction for their consideration an engineering judgment derived from similar independently tested system of similar design.
 - b. Manufacturer's engineering judgment drawings must follow requirements set forth by the International Firestop Council.

1.8 MOCK-UPS

- A. Install one firestopping assembly representative of each fire rating design required on project.
 - 1. Where one design may be used for different penetrating items or in different wall constructions, install one assembly for each different combination.
- B. If accepted, mock-up will represent minimum standard for this work.
- C. If accepted, mock-up may remain as part of this work. Remove and replace mock-ups not accepted.

1.9 PRE-INSTALLATION MEETINGS

- A. The Contractor shall conduct a pre-installation meeting at the project site a minimum of 30 days prior to any work being installed as indicated in this section and other related sections that require coordination with this section.

1.10 INSPECTIONS

- A. Inspections: Owner will engage a qualified inspector to conduct inspections required by NFPA 1 Section 12.3.2.1 (for inspections of through-penetration firestops) and such inspections shall be

conducted in accordance with ASTM E2174 Standard Practice for On-Site Inspection of Installed Firestop Systems. Inspection reports of findings shall be provided to the Owner, Architect and Construction Manager. (Three stories or more).

1.11 FIELD CONDITIONS

- A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation; maintain minimum temperature before, during, and for three days after installation of materials.
- B. Provide ventilation in areas where solvent-cured materials are being installed.

1.12 SYSTEM DESCRIPTION

- A. General: Provide firestopping systems that are produced and installed to resist the spread of fire, according to requirements indicated, and the passage of smoke and other gases.
- B. F-Rated Through-Penetration Firestop Systems: Provide through-penetration firestop systems with F ratings indicated as determined per ASTM E814, UL 1479 but not less than that equaling or exceeding the fire resistance rating of the constructions penetrated.
- C. T-Rated Through-Penetration Firestop Systems: Provide through-penetration firestop systems with T ratings, in addition to F ratings, as determined per ASTM E814, where indicated and where systems protect penetrating items exposed to contact with adjacent materials in occupiable floor areas. T-rated assemblies are required where specified by codes or where the following conditions exist:
 - 1. Where firestop systems protect penetrations located outside of wall cavities.
 - 2. Where firestop systems protect penetrations located outside fire resistive shaft enclosures.
 - 3. Where firestop systems protect penetrations located in construction containing doors required to have a temperature rise rating.
 - 4. Where firestop systems protect penetrating items larger than a 4 inch diameter nominal pipe or 16 square inch in overall cross sectional area.
- D. Fire Resistive Joint Sealants: Provide joint sealants with fire resistance ratings indicated, as determined per ASTM E119, UL 1479 and UL 2079 but not less than that equaling or exceeding the fire resistance rating of the construction in which the joint occurs.
- E. For firestopping exposed to traffic, moisture, and physical damage, provide products that do not deteriorate when exposed to these conditions and will meet load requirements.
 - 1. For piping penetrations for plumbing and wet pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
 - 2. For floor penetrations with annular spaces exceeding 4 inches in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved either by installing floor plates or by other means.
 - 3. For penetrations involving insulated piping, provide through-penetration firestop systems not required removal of insulation.
- F. For through-penetration firestop systems exposed to view, provide products with flame spread of less than 25 and smoke developed ratings of less than 450, as determined per ASTM E 84.
- G. Firestopping Materials: ASTM E119, ASTM E814, UL 263 or UL 1479 to achieve fire rating.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Firestopping Manufacturers:
 - 1. 3M Fire Protection Products.
 - 2. Hilti, Inc
 - 3. Specified Technologies Inc
 - 4. Tremco Commercial Sealants & Waterproofing; TREMstop Acrylic.
- B. Substitutions: See Section 016000 - Product Requirements for substitution procedures.

2.2 MATERIALS

- A. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.

2.3 FIRESTOPPING, GENERAL

- A. Compatibility: Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by firestopping manufacturer based on testing and field experience.
 - 1. All materials shall comply with ASTM E814 or E119 (UL 1429), and shall be manufactured of nontoxic, non-hazardous, asbestos free materials, and unaffected by water or moisture when cured.
 - 2. Primers: Conform to manufacturer's recommendations for primers required for various substrates and conditions.
 - 3. Backup Materials: Backup materials, supports, and anchoring devices shall be provided as required by UL testing.
- B. Accessories: Provide components for each firestopping system that are needed to install fill materials and to comply with "System Performance Requirements" in Part 1. Use only components specified by the firestopping manufacturer and approved by the qualified testing and inspecting agency for the designated fire resistance rated systems. Accessories include but are not limited to the following items:
 - 1. Permanent forming/damming/backing materials must be noncombustible and may include the following:
 - a. Semi-refractory fiber (mineral wool) insulation.
 - b. Sealants used in combination with other forming/damming materials to prevent leakage of fill materials in liquid state.
 - c. Joint fillers for joint sealants.
 - 2. Temporary forming materials.
 - 3. Substrate primers.
 - 4. Collars.
 - 5. Steel sleeves.
- C. Use only firestopping products that have been UL 1479 or ASTM E814 tested for specific fire rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire rating involved for each separate instance.

2.4 PENETRATION FIRESTOPPING

- A. Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.
- B. Penetrations in Fire-Resistance-Rated Walls: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).
 - 1. Fire-resistance-rated walls include fire walls fire-barrier walls smoke-barrier walls and fire partitions.
 - 2. F-Rating: Not less than the fire-resistance rating of constructions penetrated.
- C. Penetrations in Horizontal Assemblies: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).
 - 1. Horizontal assemblies include floors floor/ceiling assemblies and ceiling membranes of roof/ceiling assemblies.

2. F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated.
3. T-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
- D. Penetrations in Smoke Barriers: Provide penetration firestopping with ratings determined per UL 1479.
 1. L-Rating: Not exceeding 5.0 cfm/sq. ft. (0.025 cu. m/s per sq. m) of penetration opening at 0.30-inch wg (74.7 Pa) at both ambient and elevated temperatures.
- E. W-Rating: Provide penetration firestopping showing no evidence of water leakage when tested according to UL 1479.
- F. Exposed Penetration Firestopping: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
- G. Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping manufacturer and approved by qualified testing and inspecting agency for firestopping indicated.
 1. Temporary forming materials.
 2. Substrate primers.
 3. Collars.
 4. Steel sleeves.

2.5 MIXING

- A. For those products requiring mixing before application, comply with penetration firestopping manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

2.6 ENVIRONMENTAL

- A. Data: Submit manufacturer's product data for sealants. Indicate VOC limits of the product. Submit MSDS highlighting VOC limits in accordance with Table 1 of ASTM E2129 for products provided under work of this Section.
- B. Certification: Submit manufacturer's certification that products comply with Bay Area Resources Board, reg. 8, rule 51.
- C. VOC Content of Interior Sealants: Provide sealants and sealant primers for use inside the weatherproofing system that comply with the following limits for VOC content when calculated according to 40 CFR 59, Part 59, Subpart D (EPA Method 24):
 1. Architectural Sealants: 250 g/L.
 2. Sealant Primers for Nonporous Substrates: 250 g/L.
 3. Sealant Primers for Porous Substrates: 775 g/L.

2.7 FIRESTOPPING SYSTEMS

- A. Firestopping: Any material meeting requirements.
 1. Fire Ratings: Use system that is listed by FM (AG), ITS (DIR), or UL (FRD) and tested in accordance with ASTM E814, ASTM E119, or UL 1479 with F Rating equal to fire rating of penetrated assembly and minimum T Rating Equal to F Rating and in compliance with other specified requirements.
 2. Fire Ratings: See drawings for required systems and ratings.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify openings are ready to receive the work of this section.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other materials that could adversely affect bond of firestopping material.
- B. Remove incompatible materials that could adversely affect bond.
- C. Install backing materials to prevent liquid material from leakage.
- D. Priming: Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- E. Masking Tape: Use masking tape to prevent penetration firestopping from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing firestopping's seal with substrates.

3.3 INSTALLATION

- A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.
- B. Install labeling required by code.
- C. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
- D. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestopping.
- E. Install fill materials for firestopping by proven techniques to produce the following results:
- F. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
 - 1. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

- A. Identify penetration firestopping with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of firestopping edge so labels will be visible to anyone seeking to remove penetrating items or firestopping. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
 - 1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage".
 - 2. Contractor's name, address, and phone number.
 - 3. Designation of applicable testing and inspecting agency.
 - 4. Date of installation.
 - 5. Manufacturer's name.
 - 6. Installer's name.

3.5 FIELD QUALITY CONTROL

- A. Independent Testing Agency: Inspection agency employed and paid by Town of Canton, will examine penetration firestopping in accordance with ASTM E2174 and ASTM E2393.
- B. Repair or replace penetration firestopping and joints at locations where inspection results indicate firestopping or joints do not meet specified requirements.

3.6 CLEANING

- A. Clean adjacent surfaces of firestopping materials.

3.7 PROTECTION

- A. Protect adjacent surfaces from damage by material installation.

END OF SECTION

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SECTION 07 92 00 - JOINT SEALANTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

- A. Spray-applied joint sealants.
- B. Joint backings and accessories.

1.3 REFERENCE STANDARDS

- A. ASTM C794 - Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants; 2018 (Reapproved 2022).
- B. ASTM C834 - Standard Specification for Latex Sealants; 2017 (Reapproved 2023).
- C. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications; 2022.
- D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.
- E. ASTM C1087 - Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems; 2023.
- F. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016 (Reapproved 2023).
- G. ASTM C1247 - Standard Test Method for Durability of Sealants Exposed to Continuous Immersion in Liquids; 2020.
- H. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants; 2022.
- I. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants; 2023.
- J. ASTM C1521 - Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints; 2019 (Reapproved 2020).
- K. ASTM D1056 - Standard Specification for Flexible Cellular Materials—Sponge or Expanded Rubber; 2020.
- L. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
- M. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2022.
- N. UL 263 - Standard for Fire Tests of Building Construction and Materials; Current Edition, Including All Revisions.
- O. ACI 504 R – Guide to Joint Sealants for Concrete Structures.

1.4 REFERENCES

- A. Refer to specification Section 01 41 00 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 ACTION SUBMITTALS

- A. See Section 01 30 00 – Administrative Requirements and Section 016 00 0 – Product Requirements for submittal procedures.
- B. Product Data: Submit manufacturer's technical datasheets for each product to be used; include the following:
 - 1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.

2. List of backing materials approved for use with the specific product.
 3. Backing material recommended by sealant manufacturer.
 4. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
 5. Substrates the product should not be used on.
 6. Substrates for which use of primer is required.
 7. Installation instructions, including precautions, limitations, and recommended backing materials and tools.
 8. Sample product warranty.
 9. Certification by manufacturer indicating that product complies with specification requirements.
- C. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.
- D. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.
- E. Preconstruction Laboratory Test Reports: Submit at least four weeks prior to start of installation.
- F. Manufacturer's qualification statement.
- G. Installer's qualification statement.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this section and with at least three years of documented experience.
- C. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.
- D. Preconstruction Laboratory Testing: Arrange for sealant manufacturer(s) to test each combination of sealant, substrate, backing, and accessories.
1. Adhesion Testing: In accordance with ASTM C794.
 2. Compatibility Testing: In accordance with ASTM C1087.
 3. Allow sufficient time for testing to avoid delaying the work.
 4. Deliver sufficient samples to manufacturer for testing.
 5. Report manufacturer's recommended corrective measures, if any, including primers or techniques not indicated in product data submittals.
 6. Testing is not required if sealant manufacturer provides data showing previous testing, not older than 24 months, that shows satisfactory adhesion, lack of staining, and compatibility.
- E. Compatibility with CPVC Piping:
1. Certain sealants are not compatible with CPVC piping and can cause corrosion with piping. Sealants used for openings penetrated by CPVC piping shall be approved by piping manufacturer and documentation shall be submitted verifying that proposed sealant is approved by the respective CPVC pipe manufacturer.
- F. Field Adhesion Tests of Joints: Test for adhesion using most appropriate method in accordance with ASTM C1521, or another applicable method as recommended by manufacturer.

1.7 PRE-INSTALLATION MEETING

- A. The Contractor shall conduct a pre-installation meeting at the project site a minimum of thirty (30) days prior to any work being installed as indicated in this section and other related sections that require coordination with this section.

1.8 MOCK-UPS

- A. Mockups: Install sealant in mockups of assemblies specified in other sections that are indicated to receive joint sealants specified in this section. Use materials and installation methods specified in this section.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the 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 multi-component materials.
- B. Store and handle materials in compliance with manufacturer's requirements to prevent their deterioration or damage due to moisture, temperature, contaminants, or other causes.

1.10 FIELD CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 degrees Fahrenheit (4.44 degrees Celsius).
 - 2. When joint substrates are wet.
 - 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 - 4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.11 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Manufacturer Warranty: Provide 2-year manufacturer warranty for installed sealants and accessories that fail to achieve a watertight seal, exhibit loss of adhesion or cohesion, or do not cure. Complete forms in Owner's name and register with manufacturer.
- C. Extended Correction Period: Correct defective work within 2-year period commencing on Date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Spray-Applied Sealants:
- B. Nonsag Sealants:
 - 1. Pecora Corporation: www.pecora.com/#sle.
 - 2. QUIKRETE Companies: www.quikrete.com/#sle.
 - 3. Sherwin-Williams Company: www.sherwin-williams.com/#sle.
 - 4. Sika Corporation: usa.sika.com/#sle.
 - 5. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.
 - 6. W. R. Meadows, Inc: www.wrmeadows.com/#sle.
 - 7. Substitutions: See Section 016000 - Product Requirements for substitution procedures.
- C. Self-Leveling Sealants:

2.2 JOINT SEALANT APPLICATIONS

- A. Scope:
 - 1. Interior Joints:
 - a. Do not seal gaps and openings in gypsum board and suspended ceilings
 - b. Seal the following joints:
 - 1) Joints between door frames and adjacent construction.

2.3 JOINT SEALANTS - GENERAL

- A. Sealants and Primers: Provide products with acceptable levels of volatile organic compound (VOC) content; see Section 01 61 16.

2.4 NONSTAINING SILICONE JOINT SEALANTS

- A. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C1248.
- B. Silicone, Nonstaining, S, NS, 50, NT: Nonstaining, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 50, Use NT.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Corning Corporation; 795.
 - b. Pecora Corporation; Contractor Silicone.
 - c. Sika Corp; Sikasil WS-290.
 - d. Tremco Incorporated; Spectrem 3.
- C. Urethane Joint Sealants
 - 1. Urethane, S, NS, 25, NT: Single-component, nonsag, nontraffic-use, plus 25 percent and minus 25 percent movement capability, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) Master Builders: MasterSeal NP-1.
 - 2) Pecora Corporation; Dynatrol I-XL.
 - 3) Sika Corp.: SikaFlex 201US.
 - 4) Tremco Incorporated; Dymonic 100.
 - 2. Urethane, M, P, 25, T, NT: Multicomponent, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade P, Class 25, Uses T and NT.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) Master Builders: MasterSeal SL2.
 - 2) Pecora Corporation; Urexpand NR 200.
 - 3) Sika Corp.: SikaFlex – 2CSL
 - 4) Tremco Incorporated; Vulkem 445SSL.

2.5 IMMERSIBLE JOINT SEALANTS

- A. Immersible Joint Sealants. Suitable for immersion in liquids; ASTM C1247, Class 1 or Class 2; tested in deionized water unless otherwise indicated
- B. Urethane, Immersible, S, P, 25, T, NT, I: Immersible, single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade P, Class 25, Uses T, NT, and I.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Master Builders: MasterSeal SL-1.
 - b. Sika Corporation U.S.; SikaFlex 1c SL.
 - c. Tremco Incorporated; Vulkem 45SSL.

2.6 MILDEW-RESISTANT JOINT SEALANTS

- A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.
- B. Silicone, Mildew Resistant, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Corning Corporation; 786-M White.
 - b. Pecora Corp.: 898ST

- c. Sika Corp.: SikaSil N Plus US.
- d. Tremco Incorporated; Tremsil 200.

2.7 SECURITY SEALANTS

- A. Security Sealants: Formulated for security and institutional uses requiring elasticity and security.
- B. Pick-proof or tamper resistant sealant products.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Pecora Corporation; Dynaflex SC.
 - b. Sika Corporation US: Sikaflex CR 195.
 - c. SureBond: SB 190.

2.8 JOINT-SEALANT BACKING

- A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C1330, Type C (closed-cell material with a surface skin) or as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

2.9 ACCESSORIES

- A. Sealant Backing Materials, General: Materials placed in joint before applying sealants; assists sealant performance and service life by developing optimum sealant profile and preventing three-sided adhesion; type and size recommended by sealant manufacturer for compatibility with sealant, substrate, and application.
- B. Masking Tape: Self-adhesive, nonabsorbent, nonstaining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.
- C. Joint Cleaner: Noncorrosive and nonstaining type, type recommended by sealant manufacturer; compatible with joint forming materials.
- D. Primers: Type recommended by sealant manufacturer to suit application; nonstaining.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that joints are ready to receive work.
- B. Verify that backing materials are compatible with sealants.

3.2 PREPARATION

- A. Remove loose materials and foreign matter that could impair adhesion of sealant.
- B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.
 - 1. 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.
 - 2. Clean porous joint substrate surfaces by brushing, grinding, 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 after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
 - a. Concrete.
 - b. Masonry.
 - c. Unglazed surfaces of ceramic tile.
 - d. Exterior insulation and finish systems.

3. Remove laitance and form-release agents from concrete.
4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
 - a. Metal.
 - b. Porcelain enamel.
 - c. Glazed surfaces of ceramic tile.
- C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
- D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

3.3 INSTALLATION

- A. Install this work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Provide joint sealant installations complying with ASTM C1193.
- C. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.
- D. Install bond breaker backing tape where backer rod cannot be used.
- E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.
- F. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.
- G. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

3.4 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.6 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements for additional requirements.
- B. Perform field quality control inspection/testing as specified in PART 1 under QUALITY ASSURANCE article.
- C. Remove and replace failed portions of sealants using same materials and procedures as indicated for original installation.

3.7 JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces JS-#1.
 1. Joint Locations:
 - a. Control and expansion joints in brick pavers.
 - b. Isolation and contraction joints in cast-in-place concrete slabs.

- c. Joints between different materials listed above.
 - d. Other joints as indicated on Drawings.
 - 2. Joint Sealant: Urethane, immersible, S, P, 25, T, NT, I.
 - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- B. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces JS-#2.
 - 1. Joint Locations:
 - a. Construction joints in cast-in-place concrete.
 - b. Joints between plant-precast architectural concrete units.
 - c. Control and expansion joints in unit masonry.
 - d. Joints in glass unit masonry assemblies.
 - e. Joints in exterior insulation and finish systems.
 - f. Joints between metal panels.
 - g. Joints between different materials listed above.
 - h. Perimeter joints between materials listed above and frames of doors, windows, and louvers.
 - i. Control and expansion joints in ceilings and other overhead surfaces.
 - 2. Joint Sealant: Silicone, nonstaining, S, NS, 50, NT.
 - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- C. Joint-Sealant Application: Interior joints in horizontal traffic surfaces JS-#3.
 - 1. Joint Locations:
 - a. Isolation joints in cast-in-place concrete slabs.
 - b. Control and expansion joints in exposed cast-in-place concrete slabs.
 - c. Control and expansion joints in tile flooring.
 - d. Control and expansion joints in resinous flooring.
 - e. Insert type of joint sealant in "Joint Sealant" Subparagraph below; coordinate with Part 2. First option is example only
 - 2. Joint Sealant: Urethane, M, P, 25, T, NT.
 - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
 - a. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces JS-#4, unless noted otherwise.
 - b. Joint Locations:
 - c. Control and expansion joints on exposed interior surfaces of exterior walls.
 - d. The vertical joints in tile control and expansion joints.
 - e. Vertical joints on exposed surfaces of unit masonry, concrete, walls, and partitions.
 - f. Joints on underside of plant-precast structural concrete beams.
 - g. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
 - h. Corners of CMU construction.
 - i. Countertops and walls.
 - j. Note: Use JS-5 on vertical control joints and CMU corners up to 10'-0" AFF.
 - 4. Joint Sealant: Urethane, S, NS, 25, NT.
 - 5. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- D. Joint Sealant Application: Security sealant for interior joints on vertical surfaces up to 10'-0" AFF JS#-5.
 - 1. Joint Locations:
 - a. Control and expansion joints and CMU corners on exposed interior surface of wall and partitions below 10'-0" AFF; above 10'-0" use JS-4.
 - b. Joint Sealant: Security sealant, pick-proof and tamper resistant sealant.
 - c. Joint Sealant Color: As selected by architect from manufacturer's full range of colors.

- E. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces JS-#6.
 - 1. Joint Locations:
 - a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
 - 2. Joint Sealant: Silicone, mildew resistant, S, NS, 25, NT.
 - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors. Use clear at kitchen equipment.

END OF SECTION

SECTION 08 11 13 - HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specification and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

- A. Non-fire-rated hollow metal doors and frames.

1.3 REFERENCE STANDARDS

- A. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2024.
- B. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2023.
- C. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2020.
- D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- E. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2023, with Editorial Revision.
- F. ASTM C476 - Standard Specification for Grout for Masonry; 2023.
- G. BHMA A156.115 - Hardware Preparation in Steel Doors and Frames; 2016.
- H. NAAMM HMMA 805 - Recommended Selection and Usage Guide for Hollow Metal Doors and Frames; 2012.
- I. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames; 2024.
- J. NAAMM HMMA 840 - Guide Specifications for Receipt, Storage and Installation of Hollow Metal Doors and Frames; 2024.
- K. NAAMM HMMA 860 - Guide Specifications for Hollow Metal Doors and Frames; 2018.

1.4 REFERENCES

- A. Refer to specification Section 014100 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 ACTION SUBMITTALS

- A. See Section 013000 – Administrative Requirements and Section 016000 - Product Requirements for submittal procedures.
- B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced standards/guidelines.
- C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.
- D. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.
- E. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.
- F. Manufacturer's Qualification Statement.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.
- B. Maintain at project site copies of reference standards relating to installation of products specified.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
- B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Hollow Metal Door Frames:
 - 1. Ceco Door, an Assa Abloy Group company: www.assaabloydss.com/#sle.
 - 2. Curries, an Assa Abloy Group company: www.assaabloydss.com/#sle.
 - 3. Republic Doors, an Allegion brand: www.republicdoor.com/#sle.
 - 4. Steelcraft, an Allegion brand: www.allegion.com/#sle.
- B. Substitutions: See Section 01 60 00 - Product Requirements for substitution requirements.

2.2 PERFORMANCE REQUIREMENTS

- A. Requirements for Hollow Metal Doors and Frames:
 - 1. Steel Sheet: Comply with one or more of the following requirements; galvanized steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
 - 2. Accessibility: Comply with ICC A117.1 and ADA Standards.
 - 3. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
 - 4. Zinc Coating for Typical Interior and/or Exterior Locations: Provide metal components zinc-coated (galvanized) and/or zinc-iron alloy-coated (galvanized) by the hot-dip process in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness, unless noted otherwise for specific hollow metal doors and frames.
 - a. Based on SDI Standards: Provide at least A40/ZF120 (galvanized) when necessary, coating not required for typical interior door applications, and at least A60/ZF180 (galvanized) for corrosive locations.

2.3 HOLLOW METAL DOORS

- A. Door Finish: Factory primed and field finished.
- B. Type A, Interior Doors, Non-Fire-Rated:
 - 1. Based on NAAMM HMMA Custom Guidelines:
 - a. Comply with guidelines of NAAMM HMMA 860 for Hollow Metal Doors and Frames.
 - b. Performance Level 3 - Heavy Duty, in accordance with NAAMM HMMA 805.
 - c. Physical Performance Level B, 500,000 cycles; in accordance with ANSI/SDI A250.4.
 - d. Door Face Metal Thickness: 18 gauge, 0.042 inch (1.0 mm), minimum.
 - e. Zinc Coating: G90/Z275 galvanized coating; ASTM A653/A653M.
 - 2. Door Core Material: Manufacturers standard core material/construction and in compliance with requirements.
 - 3. Door Thickness: 1-3/4 inches (44.5 mm), nominal.
 - 4. Door Face Sheets: Flush.
 - 5. Door Finish: Factory primed and field finished.

2.4 HOLLOW METAL FRAMES

- A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.
- B. Frame Finish: Factory primed and field finished.
- C. Interior Door Frames, Non-Fire Rated: Full profile/continuously welded type.
 - 1. Frame Metal Thickness: 18 gauge, 0.042 inch (1.0 mm), minimum.

2.5 FINISHES

- A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

2.6 ACCESSORIES

- A. Door Window Frames: Door window frames with glazing securely fastened within door opening.
 - 1. Size: As indicated on drawings.
 - 2. Frame Material: 18 gauge, 0.0478 inch (1.21 mm), galvanized steel.
 - 3. Metal Finish: As selected by Architect. polyester powder coating.
- B. Glazing: As specified in Section 08 80 00, factory installed.
- C. Removable Stops: Formed sheet steel, shape as indicated on drawings, mitered or butted corners; prepared for countersink style tamper proof screws.
- D. Astragals for Double Doors: Specified in Section 08 71 00.
- E. Grout for Frames: Mortar grout complying with ASTM C476 with maximum slump of 4 inches (102 mm) as measured in accordance with ASTM C143/C143M for hand troweling in place; plaster grout and thinner pumpable grout are prohibited.
- F. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.
- G. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Verify that finished walls are in plane to ensure proper door alignment.

3.2 INSTALLATION

- A. Install frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.
- B. Coordinate frame anchor placement with wall construction.
- C. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.
- D. Comply with glazing installation requirements of Section 08 80 00.
- E. Coordinate installation of electrical connections to electrical hardware items.

3.3 TOLERANCES

- A. Maximum Diagonal Distortion: 1/16 inch (1.6 mm) measured with straight edge, corner to corner.

3.4 ADJUSTING

- A. Adjust for smooth and balanced door movement.

END OF SECTION

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SECTION 08 31 00 - ACCESS DOORS AND PANELS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein

1.2 SECTION INCLUDES

- A. Wall- and ceiling-mounted access units.

1.3 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
- C. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications; 2025a.
- D. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2023.
- E. FM (AG) - FM Approval Guide; Current Edition.
- F. ITS (DIR) - Directory of Listed Products; Current Edition.
- G. UL (FRD) - Fire Resistance Directory; Current Edition.

1.4 REFERENCES

- A. Refer to specification Section 014100 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 ACTION SUBMITTALS

- A. See Section 013000 – Administrative Requirements and Section 016000 – Product Requirements for submittal procedures.
- B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.
- C. Shop Drawings: Indicate exact position of each access door and/or panel unit.
- D. Samples: Submit two access units indicating frame configuration and anchors.
- E. Manufacturer's Installation Instructions: Indicate installation requirements.
- F. Project Record Documents: Record actual locations of each access unit.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.7 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Access Doors and Frames: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection and temperature-rise limit ratings indicated, according to NFPA 252 or UL 10B.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturer and basis of design shall be the following however products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and

functional qualities of the specified product and acceptance is provided by the Architect in writing prior to bidding.

1. Milcor, Inc. and as indicated.
- B. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product.
 1. Babcock Davis.
 2. J. L. Industries, Inc.; Div. of Activar Construction Products Group.
 3. Larsen's Manufacturing Company.
 4. Nystrom, Inc.
- C. Substitutions: See Section 016000 - Product Requirements for substitution procedures.
- D. Source Limitations: Obtain each type of access door and frame from single source from single manufacturer.

2.2 ACCESS DOORS AND PANELS ASSEMBLIES

- A. Interior Flush Access Doors with Exposed Flanges (Stainless Steel): Restrooms, Custodial Closets, and all Wet Locations
 1. Basis-of-Design: "Style MS"
 2. Assembly Description: Fabricate door to fit flush to frame. Provide manufacturer's standard-width exposed flange, proportional to door size.
 3. Locations: Wall and ceiling.
 4. Material: 16-gauge door and 16-gauge frame.
 5. Door Size: Size appropriate for concealed items to be accessed, minimum 12" x 12".
 6. Stainless-Steel Sheet for Door and frame: Nominal 0.062 inch, 16-gauge with No. 4 finish.
 7. Hinges: Manufacturer's standard.
 8. Hardware: Cam lock.
 9. Basis-of-Design: "Style NIFR" (Primed Steel)
 10. Assembly Description: Fabricate door to fit flush to frame, uninsulated. Provide self-latching door with automatic closer and interior latch release. Provide manufacturer's standard-width exposed flange, proportional to door size.
 11. Locations: Wall and Ceiling
 12. Material: Double 20-gauge door panels and 16-gauge frame.
 13. Door Size: Size appropriate for concealed items to be accessed, minimum 12" x 12".
 14. Fire-Resistance Rating: Not less than that indicated for wall type.
 15. Finish: Primed Sheet for Door and frame
 16. Hinges: Manufacturer's standard.
 17. Hardware: Cam latch and lock.
- B. Interior Fire-Rated, Flush Access Doors with Exposed Flanges (Stainless Steel): Restrooms, Custodial Closets, and all Wet Locations
 1. Basis-of-Design: "Style NIFR-S"
 2. Assembly Description: Fabricate door to fit flush to frame, uninsulated. Provide self-latching door with automatic closer and interior latch release. Provide manufacturer's standard-width exposed flange, proportional to door size.
 3. Locations: Wall and ceiling.
 4. Material: Double 20-gauge door panels and 16-gauge frame.
 5. Door Size: Size appropriate for concealed items to be accessed, minimum 12" x 12".
 6. Fire-Resistance Rating: Not less than that indicated for wall type.
 7. Hinges: Manufacturer's standard.
 8. Hardware: Cam latch and lock.

2.3 HARDWARE

- A. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.

1. Latch Type: Screwdriver operated cam lock.

2.4 MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A 879/A 879M, with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.
- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.
- D. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063.
- E. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- F. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304. Remove tool and die marks and stretch lines or blend into finish.
- G. Frame Anchors: Same type as door face.
- H. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

2.5 FABRICATION

- A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access doors to types of supports indicated.
 1. For concealed flanges with drywall bead, provide edge trim for gypsum board securely attached to perimeter of frames.
 2. For concealed flanges with plaster bead for full-bed plaster applications, provide zinc-coated expanded metal lath and exposed casing bead welded to perimeter of frames.
 3. Provide mounting holes in frames for attachment of units to metal framing.
 4. Provide mounting holes in frame for attachment of masonry anchors.

2.6 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Stainless Steel Finishes:
 1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
 2. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 3. Finish: #4 Satin
- E. Steel Finish:
 1. Factory primed.
 2. Paint for interior as indicated in the specification section "Interior Painting."
 3. Paint for exterior as indicated in the specification section "Exterior Painting."

- F. Aluminum: Mill
- G. Wall-Mounted Units:
 - 1. Panel Material: Steel, hot-dipped zinc or zinc-aluminum-alloy coated.
 - 2. Size: 12 by 12 inches (305 by 305 mm).
 - 3. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
 - 4. Wall Mounting Criteria: Provide surface-mounted face frame and door surface flush with frame surface.
- H. Wall-Mounted Units in Wet Areas:
 - 1. Panel Material: Steel, hot-dipped zinc, or zinc-aluminum-alloy coated.
 - 2. Size: 12 by 12 inches (305 by 305 mm).
 - 3. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
 - 4. Wall Mounting Criteria: Provide surface-mounted face frame and door surface flush with frame surface.
- I. Fire-Rated Wall-Mounted Units:
 - 1. Wall Fire-Rating: As indicated on drawings.
 - 2. Panel Material: Steel, hot-dipped zinc, or zinc-aluminum-alloy coated.
 - 3. Size: 12 by 12 inches (305 by 305 mm).
 - 4. Door/Panel: Uninsulated single-surface panel, with tool-operated spring or cam lock and no handle.
- J. Ceiling-Mounted Units:
 - 1. Panel Material: Aluminum extrusion with gypsum board inlay.
 - 2. Size - Other Ceilings: 12 by 12 inches (305 by 305 mm).
 - 3. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.

2.7 WALL- AND CEILING-MOUNTED ACCESS UNITS

- A. Manufacturers:
 - 1. Activar Construction Products Group, Inc. - JL Industries: www.activarcpg.com/#sle.
 - a. Multipurpose Access Panel: Activar/JL Industries TM.
 - b. Oversized Fire-Rated Access Panel: Activar/JL Industries FD2 Series.
 - 2. ACUDOR Products Inc: www.acudor.com/#sle.
 - a. Fire-Rated Wall-Mounted Units - 2 Hours or Less: ACUDOR FW-5015.
 - b. Wall- and Ceiling-Mounted Units: ACUDOR DW-5058.
 - 3. Best Access Doors: www.bestaccessdoors.com/#sle.
 - a. Universal Access Panel Drywall: Best Access Doors; Series BA-UAP.
 - 4. Substitutions: See Section 01 25 13 - Substitution Procedures.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that rough openings are correctly sized and located.
- B. Begin installation only after substrates have been properly prepared, and if the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to proceeding with this work.
- B. Prepare surfaces using methods recommended by manufacturer for applicable substrates in accordance with project conditions.

3.3 INSTALLATION

- A. Install units in accordance with manufacturer's instructions.
- B. Install frames plumb and level in openings, and secure units rigidly in place.

- C. Position units to provide convenient access to concealed equipment when necessary.

END OF SECTION

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SECTION 08 33 13 - COILING COUNTER DOORS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES:

- A. Provide labor, material, services and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
 - 1. Counter doors.

1.3 REFERENCES:

- A. Refer to specification Section 014100 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.4 ACTION SUBMITTALS

- A. See Section 013000 – Administrative Requirements and Section 016000 – Product Requirements for submittal procedures.
- B. Product Data: For each type and size of coiling counter door and accessory.
 - 1. Include construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.
 - 3. Include description of automatic closing device and testing and resetting instructions.
- C. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.
 - 1. Include plans, elevations, sections, and mounting details.
 - 2. Include details of equipment assemblies, and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
 - 4. Show locations of controls, locking devices, detectors or replaceable fusible links, and other accessories.
 - 5. Include diagrams for power, signal, and control wiring.
- D. Provide additional submittal requirements as requested to support the projects compliance with Green Globe's Building Initiative. Refer to Section 01 81 13 - Green Building Initiative Requirements for additional information.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For coiling counter doors to include in maintenance manuals.
- B. Product Certificates: For compliance with fire-rated requirements.
- C. Product Test Reports: For product test performed by qualified testing lab.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturer shall be one of the following however products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product and acceptance is provided by the Architect in writing prior to bidding.
- B. Door Curtain Material: Stainless steel.
 - 1. Cookson Company.
 - 2. Cornell Iron Works, Inc.
 - 3. Overhead Door Corporation.

2.2 COUNTER DOOR ASSEMBLY

- A. Counter Door: Coiling counter door formed with curtain of interlocking metal slats.
- B. Operation Cycles: Door components and operators capable of operating for not less than 50,000. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.
 - 1. Include tamperproof cycle counter.
- C. STC Rating: 26.
 - 1. Door Curtain Material: Stainless steel.
- D. Door Curtain Slats: Flat profile slats of 1-1/4-inch (32-mm) center-to-center height.
 - 1. Gasket Seal. Manufacturer's standard continuous gaskets between slats.
- E. Bottom Bar: Manufacturer's standard continuous channel or tubular shape, fabricated stainless steel and finished to match door.
- F. Curtain Jamb Guides: Stainless steel with exposed finish matching curtain slats. Provide continuous integral wear strips to prevent metal-to-metal contact and to minimize operational noise.
- G. Hood: Stainless steel.
 - 1. Shape: Square.
 - 2. Mounting: Face of wall.
- H. Integral Frame, Hood, and Fascia: Stainless steel.
 - 1. Mounting: Face of wall.
- I. Sill Configuration: No sill.
- J. Door Finish:
 - 1. Stainless-Steel Finish: No. 4 (polished directional satin).

2.3 DOOR CURTAIN MATERIALS AND CONSTRUCTION

- A. Door Curtains: Fabricate coiling counter-door curtain of interlocking metal slats in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:
- B. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain.

2.4 HOODS

- A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any

portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.

- B. Stainless Steel: 0.025-inch- (0.64-mm-) thick stainless-steel sheet, Type 304, complying with ASTM A 666.
- C. Integral Frame, Hood, and Fascia: Welded sheet metal assembly of the following sheet metal(s):
 - 1. Stainless Steel: Type 304, complying with ASTM A 666.

2.5 COUNTER DOOR ACCESSORIES

- A. Integral Metal Sill: Fabricate sills as integral part of frame assembly of Type 304 stainless steel in manufacturer's standard thickness with No. 4.

2.6 LOCKING DEVICES

- A. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.
 - 1. Lock Cylinders: Compatible with facility and keyed to building keying system.
 - 2. Keys: Three for each cylinder.

2.7 COUNTERBALANCING MECHANISM

- A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.
- B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. (2.5 mm/m) of span under full load.
- C. Counterbalance Spring: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.
- D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.
- E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.8 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM/NOMMA's "Metal Finishes Manual for Architectural and Metal Products (AMP 500-06)" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.9 STAINLESS-STEEL FINISHES

- A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
- B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - 1. Run grain of directional finishes with long dimension of each piece.
 - 2. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
 - 3. Directional Satin Finish: No. 4.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.

- B. Examine locations of electrical connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install coiling counter doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.
- B. Install coiling counter doors, hoods, controls, and operators at the mounting locations indicated for each door.

3.3 ADJUSTING

- A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
- B. Lubricate bearings and sliding parts as recommended by manufacturer.
- C. Adjust seals to provide tight fit around entire perimeter.

END OF SECTION

SECTION 08 33 23 - OVERHEAD COILING DOORS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specification and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.
- B. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specification and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

- A. Exterior insulated coiling doors.

1.3 REFERENCE STANDARDS

- A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

1.4 REFERENCES

- A. Refer to specification Section 014100 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Shop Drawings: Indicate pertinent dimensioning, anchorage methods, hardware locations, and installation details.
- C. Samples: Two slats, in size illustrating shape, color and finish texture.
- D. Manufacturer's Installation Instructions: Indicate installation sequence and procedures, adjustment and alignment procedures.
- E. Manufacturer's qualification statement.
- F. Installer's qualification statement.
- G. Maintenance Data: Indicate lubrication requirements and frequency and periodic adjustments required.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years documented experience.

1.7 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Manufacturer Warranty: Provide 2-year manufacturer warranty for roller shaft counterbalance assembly. Complete forms in Town of Canton's name and register with manufacturer.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Overhead Coiling Metal Doors:
 - 1. Cornell Iron Works, Inc: www.cornelliron.com/#sle.
 - 2. Substitutions: See Section 01 60 00 - Product Requirements.

2.2 COILING DOORS

- A. Basis of Design: ESD30 Exterior Coiling Steel slat door.
 - 1. Capable of withstanding positive and negative wind loads of 20 psf (940 Pa) without undue deflection or damage to components.
 - 2. Sandwich Slats: Manufacturer's standard, galvanized steel with GalvaNex finish with core of foamed-in-place polyurethane insulation; minimum R-value of 4.88 (RSI-value of 0.86).
 - 3. Nominal Slat Size: 2 inches (50 mm) wide by required length.
 - 4. Finish: Factory painted, color as selected by Architect.
 - 5. Guides, Formed Sheet Metal: Galvanized steel. Thermally broken structural steel with powder coating finish to match curtain.
 - 6. Bottom Bar: Powder coated steel to match curtain.
 - 7. Hood Enclosure: Galvanized steel with GalvaNex finish, ; match curtain.
 - 8. Counter Balance Shaft: Steel construction with torsion sp
 - 9. Manual hand chain lift operation.
 - 10. Mounting: Within framed opening.
 - 11. Locking Devices: Lock and latch handle on outside.

2.3 MATERIALS

- A. Metal Curtain Construction: Double skin Interlocking roll formed interior and exterior slats.
 - 1. Curtain Bottom for Slat Curtains: Fitted with angles to provide reinforcement and positive contact in closed position.
 - 2. Weatherstripping for Exterior Doors: Moisture and rot proof, resilient type, located at jamb edges, bottom of curtain, and where curtain enters hood enclosure of exterior doors.
 - 3. Steel Slats: Minimum thickness, 20 gauge; ASTM A653/A653M galvanized steel sheet.
- B. Guide Construction: Continuous, of profile to retain door in place with snap-on trim, mounting brackets of same metal.
- C. Guides - Sheet Metal: Formed from sheet metal..
 - 1. Hot-Dip Galvanizing: Minimum G90 (Z275) coating, in compliance with ASTM A653/A653M.
- D. Hood Enclosure and Trim: Internally reinforced to maintain rigidity and shape.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that adjacent construction is suitable for door installation.
- B. Verify that door opening is plumb, header is level, and dimensions are correct.
- C. Notify Architect of any unacceptable conditions or varying dimensions.
- D. Commencement of installation indicates acceptance of substrate and door opening conditions.

3.2 INSTALLATION

- A. Install units in accordance with manufacturer's instructions.
- B. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.
- C. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.
- D. Fit and align assembly including hardware; level and plumb, to provide smooth operation.
- E. Install enclosure and perimeter trim.

3.3 TOLERANCES

- A. Maintain dimensional tolerances and alignment with adjacent work.
- B. Maximum Variation From Plumb: 1/16 inch (1.6 mm).

- C. Maximum Variation From Level: 1/16 inch (1.6 mm).
- D. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch per 10 feet (3.2 mm per 3 m) straight edge.

3.4 ADJUSTING

- A. Adjust operating assemblies for smooth and noiseless operation.

3.5 CLEANING

- A. Clean installed components.
- B. Remove labels and visible markings.

END OF SECTION

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SECTION 08 41 13 - ALUMINUM FRAMED ENTRANCES AND STOREFRONTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES:

- A. Provide labor, material, services and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
 - 1. Exterior storefront systems.

1.3 REFERENCE STANDARDS

- A. AA (Aluminum Association) – Designation System for Aluminum Finishes.
- B. AAMA Series number 11 – Design Wind Loads for Buildings and Boundary Layer Wind Tunnel Testing.
- C. AAMA 101 – Standard Specification for Window, Doors, and Skylights.
- D. AAMA 200 – Standard Practice for the Installation of Windows with Frontal Flanges for Surface Barrier Masonry Construction.
- E. ASCE 7 – Minimum Design Loads for Buildings and other Structures.
- F. ASTM A123/A123M – Standard Specification for Zinc (Hot Dip Galvanized) Coatings on Iron and steel products.
- G. ASTM B209 – Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- H. ASTM B221 – Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
- I. ASTM C509 – Standard Specification for Elastomeric Cellular Preformed Gasket and Sealing Material.
- J. ASTM D2000 – Standard Classification System for Rubber Products in Automotive Applications.
- K. ASTM D2287 – Standard Specification for Non-Rigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds.
- L. ASTM E283 – Standard Test Method for Determining the Rate of Air Leakage.
- M. Exterior Windows, Curtain Walls and Doors Under Specified Pressure Differences Across the Specimen.
- N. ASTM E330 – Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
- O. ASTM E331 – Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
- P. ASTM E1105 – Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform or Cyclic Static Air Pressure Difference.
- Q. ASTM F588 – Standard Test Methods for Measuring the Forced Entry Resistance of Window Assemblies, Excluding Glazing Impact.
- R. ADA/ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disability Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities."

1.4 REFERENCES

- A. Refer to specification Section 01 41 00 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 ACTION SUBMITTALS

- A. See Section 01 30 00 – Administrative Requirements and Section 01 60 00 – Product Requirements for submittal procedures.
- B. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Include details of provisions for system expansion and contraction and for drainage of moisture in the system to the exterior.
 - 2. For entrance doors, include hardware schedule and indicate operating hardware types, functions, quantities, and locations.
- D. Samples: For units with factory-applied finishes.
- E. Fabrication Sample: Of each vertical-to-horizontal intersection of aluminum-framed systems, made from 12-inch (300-mm) lengths of full-size components and showing details of the following:
 - 1. Joinery, including concealed welds.
 - 2. Anchorage.
 - 3. Expansion provisions.
 - 4. Glazing.
 - 5. Flashing and drainage.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer and testing agency.
- B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for aluminum-framed systems, indicating compliance with performance requirements.
- C. Warranties: Sample of special warranties.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A manufacturer capable of fabricating glazed aluminum storefront and entrance systems that meet or exceed energy performance requirements indicated and of documenting this performance by certification, labeling, and inclusion in lists.
- B. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- C. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.
- D. Engineering Responsibility: Prepare data for aluminum-framed systems, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in systems similar to those indicated for this Project.
- E. Product Options: Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.
 - 1. Do not revise intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If revisions are proposed, submit comprehensive explanatory data to Architect for review.

- F. Energy Performance Standards: Comply with NFRC for minimum standards of energy performance, materials, components, accessories, and fabrication. Comply with more stringent requirements if indicated.
- G. Accessible Entrances: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines.
- H. Source Limitations for Aluminum-Framed Systems: Obtain from single source from single manufacturer.

1.8 PRE-INSTALLATION MEETING

- A. The Contractor shall conduct a pre-installation meeting at the project site a minimum of 30 days prior to any work being installed as indicated in this section and other related sections that require coordination with this section.
- B. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
- C. Review and discuss the finishing that is required to be coordinated with the finishing of other aluminum work for color and finish matching.
- D. Review, discuss, and coordinate the interrelationship with other exterior wall components. Include provisions for anchoring, flashing, weeping, sealing perimeters, and protecting finishes.
- E. Review and discuss the sequence of work required to construct a watertight and weathertight exterior building envelope.
- F. Inspect and discuss the condition of substrate and other preparatory work performed by other trades.

1.9 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on Shop Drawings.

1.10 WARRANTY

- A. Warranty: Standard form in which manufacturer and installer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Noise or vibration caused by thermal movements.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - d. Adhesive or cohesive sealant failures.
 - e. Water leakage through fixed glazing and framing areas.
 - f. Failure of operating components.
 - 2. Warranty Period for installer: Two (2) years from date of Substantial Completion.
 - 3. Warranty Period for manufacturer: Five (5) years from date of Substantial Completion.
- B. Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes do not comply with requirements or that fail in materials or workmanship within specified warranty period. Warranty does not include normal weathering.
 - 1. 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. Warranty Period: Five (5) years from date of Substantial Completion.

1.11 PERFORMANCE REQUIREMENTS

- A. General Performance: Aluminum-framed systems shall withstand the effects of the following performance requirements without exceeding performance criteria or failure due to defective manufacture, fabrication, installation, or other defects in construction.
 - 1. Movements of supporting structure indicated on Drawings including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads.
 - 2. Dimensional tolerances of building frame and other adjacent construction.
 - 3. Failure includes the following:
 - a. Deflection exceeding specified limits.
 - b. Thermal stresses transferring to building structure.
 - c. Framing members transferring stresses, including those caused by thermal and structural movements to glazing.
 - d. Glazing-to-glazing contact.
 - e. Noise or vibration created by wind and by thermal and structural movements.
 - f. Loosening or weakening of fasteners, attachments, and other components.
 - g. Sealant failure.
 - h. Failure of operating units.
- B. Structural Loads:
 - 1. Wind Loads: Basic wind speed, importance factor and exposure category shall be as indicated on Structural Drawings.
- C. Deflection of Framing Members:
 - 1. Deflection Normal to Wall Plane: Limited to $1/175$ of clear span for spans up to 13 feet 6 inches and to $1/240$ of clear span plus $1/4$ inch for spans greater than 13 feet 6 inches and shall also comply with the impact certification requirements.
 - 2. Deflection Parallel to Glazing Plane: Limited to $L/360$ of clear span or $1/8$ inch, whichever is smaller and shall comply with the impact certification requirements.
- D. Structural-Test Performance: Provide aluminum-framed systems tested according to ASTM E 330 as follows:
 - 1. Wind Loads: Basic wind speed, importance factor and exposure category shall be as indicated on drawings.
 - 2. Deflection Normal to Wall Plane: Limited to $1/175$ of clear span for spans up to 13 feet 6 inches or $3/4$ ".
- E. Air Infiltration: Provide aluminum-framed systems with maximum air leakage through fixed glazing and framing areas to comply with manufacturers testing of fixed wall area when tested according to ASTM E 283 at a minimum static-air-pressure difference of 6.24 lbf/sq. ft. (300 Pa).
- F. Water Penetration under Static Pressure: Provide aluminum-framed systems that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.
- G. Water Penetration under Dynamic Pressure: Provide aluminum-framed systems that do not evidence water leakage through fixed glazing and framing areas when tested according to AAMA 501.1 under dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.
- H. Thermal Movements: Provide aluminum-framed systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2. Test Performance: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.
 - a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 deg F (82 deg C).
 - b. Low Exterior Ambient-Air Temperature: 0 deg F (minus 18 deg C).
3. Interior Ambient-Air Temperature
- I. Condensation Resistance: Provide aluminum-framed systems with fixed glazing and framing areas having condensation-resistance factor (CRF) of not less than 45.
- J. Thermal Conductance: Provide aluminum-framed systems with fixed glazing and framing areas having an average U-factor of not more than 0.57 Btu/sq. ft. x h x deg F.
 1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
 2. Test Interior Ambient-Air Temperature: 75 deg F (24 deg C).
 3. Test Performance: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.
- K. Sound Transmission: Provide aluminum-framed systems with fixed glazing and framing areas having the following sound-transmission characteristics:
 1. Sound Transmission Class (STC): Minimum 32 STC when tested for laboratory sound transmission loss according to ASTM E 90 and determined by ASTM E 413 and ASTM E 1332.
- L. Delegated Design: Design aluminum-framed systems, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated if design exceeds limitations of the impact certification and provide additional elements as required to meet design loads.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturer and basis of design shall be the following however products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product and acceptance is provided by the Architect in writing prior to bidding.
 1. Kawneer
- B. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product.
 1. EFCO
 2. YKK AP American, Inc.

2.2 FRAMING SYSTEMS

- A. Trifab® VersaGlaze® 451T Framing System:
 1. 2" x 4-1/2" (50.8 mm x 114.3 mm) nominal dimension.
 2. Non-thermal.
 3. Front, center, back, multi-plane, structural silicone or weatherseal (type B) glazed.
 4. Screw spline, shear block, stick, or punched opening.
- B. Brackets and Reinforcements:
 1. Manufacturer's standard high-strength aluminum with non-staining, non-ferrous shims for aligning system components.
- C. Fasteners and Accessories:
 1. Manufacturer's standard corrosion-resistant, non-staining, non-bleeding fasteners and accessories must be compatible with adjacent materials.
 2. Where exposed, fasteners and accessories shall be stainless steel.

- D. Perimeter Anchors:
 - 1. When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action.
- E. Packing, Shipping, Handling, and Unloading:
 - 1. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- F. Storage and Protection:
 - 1. Store materials so that they are protected from exposure to harmful weather conditions.
 - 2. Handle material and components to avoid damage.
 - 3. Protect material against damage from elements, construction activities, and other hazards before, during, and after installation.

2.3 ENTRANCE DOOR SYSTEM

- A. The door stile and rail face dimensions of the entrance door will be as follows:
 - 1. 190 Swing Door.
 - 2. Vertical face dimension: 2-1/8" (54.0 mm).
 - 3. Top Rail: 2-1/4" (57.2 mm).
 - 4. Bottom Rail: 3-7/8" (98.4 mm).
 - 5. Optional Bottom Rail: 10" (254.0 mm).
- B. Major portions of the door members shall be 0.125" (3.2 mm) nominal thickness.
- C. Glazing molding shall be 0.05" (1.3 mm) thick.
- D. Glazing gaskets shall be either EPDM elastomeric extrusions or a thermoplastic elastomer.
- E. Provide adjustable glass jacks to help center the glass in the door opening.

2.4 ENTRANCE DOOR HARDWARE

- A. Door Hardware: Refer to section 08 71 00 - Door Hardware.

2.5 GLAZING SYSTEMS

- A. Glazing to meet requirements in Division 08 Glazing Section.
- B. Glazing Gaskets:
 - 1. Manufacturer's standard compression types.
 - 2. Replaceable, extruded EPDM rubber.
- C. Spacers and Setting Blocks:
 - 1. Manufacturer's standard elastomeric type.
- D. Bond-Breaker Tape:
 - 1. Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.
- E. Glazing Sealants for structural-sealant-glazed systems as recommended by manufacturer for joint type, and as follows:
 - 1. Structural Sealant:
 - a. ASTM C 1184.
 - b. Single-component neutral-curing silicone formulation that is compatible with the system components with which it comes in contact
 - c. Specifically formulated and tested for use as structural sealant and approved by a structural-sealant manufacturer for use in the aluminum-framed systems indicated.
 - d. Color: Black.
 - 2. Weatherseal sealant:
 - a. ASTM C 920 for Type S, Grade NS, Class 25, Uses NT, G, A, and O.
 - b. Single-component neutral-curing formulation that is compatible with the structural sealant and other system components with which it comes in contact.

- c. Recommended by structural-sealant, weatherseal-sealant, and aluminum-framed-system manufacturers for this use.
- d. Color: Matching structural sealant.

2.6 MATERIALS

- A. Aluminum Extrusions:
 - 1. Alloy and temper recommended by aluminum storefront manufacturer for strength, corrosion resistance, and application of required finish.
 - 2. Framing: Not less than 0.070" (1.8 mm) wall thickness at any location for the main frame.
 - 3. Doors: Not less than 0.090" (2.3 mm) wall thickness at any location for the main frame and door leaf members.
 - 4. Complying with ASTM B221: 6063-T6 alloy and temper.
- B. Fasteners:
 - 1. Nonmagnetic stainless steel or other materials must be non-corrosive and compatible with aluminum members, trim hardware, anchors, and other components.
- C. Anchors, Clips, and Accessories:
 - 1. Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating.
 - 2. Anchors, clips, and accessories shall provide sufficient strength to withstand the design pressure indicated.
- D. Reinforcing Members:
 - 1. Aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating.
- E. Sealant:
 - 1. For sealants required within fabricated storefront system, provide permanently elastic, non-shrinking, and non-migrating type recommended by sealant manufacturer for joint size and movement.
- F. Tolerances:
 - 1. References to tolerances for wall thickness and other cross-sectional dimensions of storefront members are nominal and in compliance with AA Aluminum Standards and Data.

2.7 ACCESSORIES

- A. Joint Sealants:
 - 1. For installation at perimeter of aluminum-framed systems, as specified in Division 07 Joint Sealants Section.
- B. Bituminous Paint:
 - 1. Cold-applied asphalt-mastic paint
 - 2. Complies with SSPC-Paint 12 requirements except containing no asbestos
 - 3. Formulated for 30-mil (0.762 mm) thickness per coat

2.8 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:
 - 1. Profiles that are sharp, straight, and free of defects or deformations.
 - 2. Accurately fitted joints with ends coped or mitered.
 - 3. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
 - 4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.

5. Provisions for field replacement of glazing from exterior.
6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- C. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
 1. At exterior doors, provide compression weather stripping at fixed stops.
- D. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
 1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
 2. At exterior doors, provide weather sweeps applied to door bottoms.
- E. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.
- F. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.9 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Sections shall be free of scratches and other serious surface blemishes and chemically cleaned.
- B. Aluminum Surfaces: Sections shall be free of scratches and other serious surface blemishes and chemically cleaned.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- E. Factory Finishing:
 1. Kawneer Permanodic® AA-M10C21A44, AAMA 611, Architectural Class I Color Anodic Coating.
 - a. Color: Dark bronze.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General:
 1. Comply with manufacturer's written instructions.
 2. Do not install damaged components.
 3. Fit joints to produce hairline joints free of burrs and distortion.
 4. Rigidly secure nonmovement joints.
 5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
 6. Seal joints watertight unless otherwise indicated.
- B. Metal Protection: Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or applying sealant or tape, or by installing nonconductive spacers as recommended by manufacturer for this purpose.

- C. Corrosion Protection: Coat concealed surfaces that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- D. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.
- E. Set continuous sill members and flashing in full sealant bed as specified in Section 079200 "Joint Sealants" to produce weathertight installation.
- F. Sill Pan Installation: Install sill pan in full bed of sealant on concrete slab prior to installing system.
- G. Install components plumb and true in alignment with established lines and grades, and without warp or rack.
- H. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping. Indicate entrance door hardware mounting heights on Drawings or insert in subparagraph below.
 - 1. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.
- I. Install perimeter joint sealants as specified in specification section "Joint Sealants" to produce weathertight installation.
- J. Install glazing as specified in specification section "Glazing."

3.3 ERECTION TOLERANCES

- A. Install aluminum-framed systems to comply with the following maximum erection tolerances:
 - 1. Location and Plane: Limit variation from true location and plane to 1/8 inch in 10 feet (3 mm in 3.7 m); 1/4 inch (6 mm) over total length.
 - 2. Alignment:
 - a. Where surfaces abut in line, limit offset from true alignment to 1/16 inch (1.5 mm).
 - b. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch (0.8 mm).
- B. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch (3 mm).

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections.
- B. Testing Services: Testing and inspecting of representative areas of glazed aluminum framed assemblies shall take place as installation proceeds to determine compliance of installed assemblies with specified requirements.
 - 1. Air Infiltration: Areas shall be tested for air leakage based on performance requirements (2.25 L/s per sq. m) to comply with manufacturer's test results of wall area when tested according to ASTM E 783 at a minimum static-air-pressure differential of (75 Pa)6.24 lbf/sq. ft. (300 Pa).
 - a. Test Area: One bay wide, but not less than 20 feet (9.1 m), by one story of glazed aluminum framed assemblies.
 - b. Perform a minimum of two tests in areas as directed by Architect.
 - 2. Water Penetration: Areas shall be tested according to ASTM E 1105 at a minimum uniform and cyclic static-air-pressure differential of not less than 6.24 lbf/sq. ft. (300 Pa), and shall not evidence water penetration.
 - a. Test Area: One bay wide, but not less than 20 feet (9.1 m), by one story of glazed aluminum framed assemblies.
 - b. Perform a minimum of two tests in areas as directed by Architect.
 - 3. Water Spray Test: Before installation of interior finishes has begun, areas designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.
 - a. Test Area: A minimum area of 75 feet (23 m) by one story of glazed aluminum framed assemblies.

- C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- D. Aluminum framed assemblies will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports.

3.5 ADJUSTING

- A. Adjust operating entrance door hardware to function smoothly as recommended by manufacturer.
- B. For entrance doors accessible to people with disabilities, adjust closers to provide a 3-second closer sweep period for doors to move from a 70-degree open position to 3 inches from the latch, measured to the leading door edge.

END OF SECTION

SECTION 08 62 00 - UNIT SKYLIGHTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

- A. Provide labor, material, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
 - 1. Dome unit skylights with formed curb counterflashing for mounting on site-built or prefabricated roof curbs,

1.3 REFERENCE STANDARDS

- A. AAMA/WDMA/CSA 101/I.S.2/A440 - North American Fenestration Standard/ Specification for Windows, Doors, and Skylights (NAFS).
- B. CSA A440S1 – Canadian Supplement to AAMA/WDMA/CSA 101/I.S.2/A440.
- C. AAMA 502 – Voluntary Specification for Field Testing of Newly Installed Fenestration Products.
- D. AAMA 2603 – Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum and Panels.
- E. ASTM D1003 – Standard Test Method for Haze and Luminous Transmittance of Transparent Plastics.
- F. ASTM E108 - Standard Test Methods for Fire Tests of Roof Coverings.
- G. ASTM E283 - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
- H. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
- I. ASTM E408 - Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques.
- J. AAMA 501.2 - Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems; 2015.
- K. AAMA/WDMA/CSA 101/I.S.2/A440 - North American Fenestration Standard/Specification for Windows, Doors, and Skylights; 2022, with Errata (2023).
- L. ASTM B308/B308M - Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles; 2020.

1.4 REFERENCES

- A. Refer to specification Section 01 41 00 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 ACTION SUBMITTALS

- A. See Section 01 30 00 – Administrative Requirements and Section 01 60 00 – Product Requirements for submittal procedures.
- B. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for unit skylights.
- C. Shop Drawings: Include plans, elevations, sections, details, and connections to supporting structure and other adjoining work.

- D. Aluminum Finish Samples: For each type of exposed finish required, in a representative section of each unit skylight in manufacturer's standard size.
- E. Glazing Samples: For each color and finish of glazing indicated, 12 inches (304.8 mm) square and of same thickness indicated for the final Work.
- F. Delegated-Design Submittal: Submit design calculations, analysis data and shop drawings indicating compliance with dedicated design requirements signed and sealed by the qualified Florida registered professional engineer responsible for their preparation.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer and manufacturer.
- B. Product Test Reports: For each type and size of unit skylight, for tests performed within the last four years by a qualified testing agency. Test results based on testing of smaller unit skylights than specified will not be accepted.
- C. Field quality-control reports.
- D. Sample Warranty: For special warranty.

1.7 PREINSTALLATION MEETINGS

- A. The Contractor shall conduct a pre-installation meeting at the project site a minimum of 30 days prior to any work being installed as indicated in this section and other related sections that require coordination with this section.

1.8 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For unit skylights to be included in maintenance manuals.

1.9 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Provide products from a firm that makes the indicated products as a regular production item and with not less than ten (10) years experience.
- B. Installer Qualifications: An installer acceptable to unit skylight manufacturer for installation of units required for this Project.

1.10 WARRANTY

- A. General: Warranties specified in this section shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.
- B. Skylight Warranty: Provide written warranty signed by manufacturer, agreeing to repair or replace work that exhibits defects in materials or workmanship and guaranteeing weather-tight and leak-free performance. "Defects" is defined as uncontrolled leakage of water and abnormal aging or deterioration.
 - 1. 15 Years: Polycarbonate dome skylights including water penetration and hail breakage for hailstones 2 inches and less in diameter. Mill finished aluminum skylight frames.
 - 2. 10 Years: Yellowing of acrylic and polycarbonate skylight domes.
 - 3. 5 Years: Acrylic dome skylights, skylight model CDS with polycarbonate dome, aluminum curbs, external safety cage, internal safety screen accessory, internal security bars accessory, ventilation curb extension.
 - 4. 1 Year: Steel curbs

1.11 PERFORMANCE REQUIREMENTS

- A. Unit Skylight Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.
 - 1. Certification: AAMA-, WDMA-, or CSA-certified unit 101 I.S.2 A440 skylights with label attached to each.

- B. Delegated-Design: Provide delegated design services including calculations and shop drawings for load bearing items to comply with performance requirements, applicable code requirements and design criteria signed and sealed by an engineer registered in the State of Florida.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturer and basis of design shall be the following however products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product and acceptance is provided by the Architect in writing prior to bidding.
 - 1. Velux America, LLC.
- B. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product.
 - 1. Maxim Skylights
 - 2. Bristolite Daylighting Systems
 - 3. Wasco Skylights

2.2 UNIT SKYLIGHTS

- A. Basis of Design: "CMT2".
- B. General: Provide factory-assemble, traditional dome, fixed skylight utilizing extruded aluminum frame counter-flashing with welded corners, a PVC inner frame allowing condensation drainage, structural sealant, integral double sided insulated aluminum curb and accessories, as required to meet installation and performance requirements indicated.
- C. Thermoformed Traditional Dome: Outer dome shall be formed from smooth sheet and not prismatic in order to transmit all incident daylight through outer dome. [Provide outer polycarbonate domes with integral UV blocking cap layer that prevents long-term yellowing, and insures material strength and performance stability.
- D. Aluminum Frame Counter-flashing: Maintenance-free, extruded aluminum, grade 6063-T6, 0.08 inch (2.0 mm) thick with [mill] [neutral grey powder coat] finish. Counter-flashing frames completely welded in corners and counter flashes curb a minimum of 1.625 inches (41 mm). Provide aluminum frame with at least 0.5 inch (12 mm) continuous ledge on each side of the skylight that is a pinch free access for stacking, manual transportation and mounting of skylights.
- E. Curb: Minimum 4" wide, minimum height as indicated on the drawings, field built or prefabricated (By others).
- F. Condensation Control: Fabricate skylight units with integral internal gutters and weeps to collect and dispose of condensation.
- G. Shape and Size: As indicated on drawings.

2.3 MATERIALS

- A. Curb Frame: Extruded aluminum alloy 6063-T5 (min). ASTM B221 (((ASTM B221M))) with minimum effective thickness of 0.60 inch (15.24 mm). Provide integral condensation gutter system with corners fully welded for waterproof quality.
- B. 100% Thermally Broken PVC inner-frame for Condensation Drainage: Factory applied white PVC inner-frame assembly providing a thermal break weather seal and drainage for condensation. The inner-frame design allows positive condensation to the exterior of the curb without exposed drainage openings in the aluminum frame that can introduce air infiltration into the skylight. The PVC inner-frame construction consists of coextruded fins allowing for a dry installation of skylight to the curb, eliminating weather seal strips or caulking at the top of the curb.
- C. Structural Sealant: Factory applied InstantGlaze sealant, bonding the dome to the aluminum frame and suitable for external exposure.

- D. Gaskets: Structural glazing tape to form adhesive bond between curb and inner dome, between inner and outer dome, and between outer dome and extruded aluminum retainer. Gaskets form an air and water impenetrable barrier between adjacent surfaces.
- E. Fasteners: Same metal as metals being fastened, or nonmagnetic stainless steel or other non-corrosive metal as recommended by manufacturer.

2.4 CURBS

- A. Aluminum Curb: Factory insulated aluminum curb, 1.5 inches in thickness with 22 gauge (0.025") white finished aluminum interior and 20 gauge (0.032") mill finished aluminum exterior. Curb factory insulated with 1.5 inches of expanded polystyrene board having a 5.8 R-value. Width, height and length of curb shall be as indicated. Curb roof mounting flange shall be a minimum 2.75 inches in width. Basis of Design: VELUX America LLC, Model CCAW.

2.5 FALL PROTECTION AND SECURITY

- A. Manufacturer's standard integral safety screen and security bars.

2.6 FABRICATION

- A. Factory fit and assemble components.
- B. Fabricate components that, when assembled, will have accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion.
- C. Fabricate components to drain water passing joints and to drain condensation and moisture occurring or migrating within skylight system to the exterior.
- D. Fabricate components to accommodate expansion, contraction, and field adjustment, and to provide for minimum clearance and shimming at skylight perimeter.
- E. Fabricate components to ensure that glazing is thermally and physically isolated from framing members.
- F. Form shapes with sharp profiles, straight and free of defects or deformations, before finishing.
- G. Fit and secure joints by heliarc welding.

2.7 ALUMINUM FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Sections shall be free of scratches and other serious surface blemishes and chemically cleaned.
- B. Aluminum Surfaces: Sections shall be free of scratches and other serious surface blemishes and chemically cleaned.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Comply with manufacturer's written instructions for protecting, handling, and installing skylight components.

- B. Coordinate installation of unit skylight with installation of substrates, vapor retarders, roof insulation, roofing membrane, and flashing as required to ensure that each element of the Work performs properly and that combined elements are waterproof and weathertight.
- C. Comply with recommendations in AAMA 1607 and with manufacturer's written instructions for installing unit skylights.
- D. Install unit skylights level, plumb, and true to line, without distortion.
- E. Anchor unit skylights securely to supporting substrates.
- F. Where aluminum surfaces of unit skylights will contact another metal or corrosive substrates, such as preservative-treated wood, apply bituminous coating on concealed metal surfaces or provide other approved permanent separation recommended in writing by unit skylight manufacturer.
- G. Counter Flashing: Where counter flashing is required as a component of the skylight, install to provide an adequate waterproof overlap with roofing or roof flashing (as counter flashing). Seal with thick bead of mastic sealant, except where overlap is indicated to be left open for ventilation.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. After completion of installation and nominal curing of sealant and glazing compounds but before installation of interior finishes, test for water leaks according to AAMA 501.2.
- C. Perform test for total area of each unit skylight.
- D. Work will be considered defective if it does not pass tests and inspections.
- E. Additional testing and inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- F. Prepare test and inspection reports.

3.4 CLEANING

- A. Clean exposed unit skylight surfaces according to manufacturer's written instructions. Touch up damaged metal coatings and finishes.
- B. Remove excess sealants, glazing materials, dirt, and other substances.
- C. Remove and replace glazing that has been broken, chipped, cracked, abraded, or damaged during construction period.
- D. Protect unit skylight surfaces from contact with contaminating substances resulting from construction operations.

END OF SECTION

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SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:

1. Mechanical door hardware

B. Section excludes:

1. Windows
2. Cabinets (casework), including locks in cabinets
3. Signage
4. Toilet accessories
5. Overhead doors

C. Related Sections:

1. Division 01 "General Requirements" sections for Allowances, Alternates, Owner Furnished Contractor Installed, Project Management and Coordination.
2. Division 06 Section "Rough Carpentry"
3. Division 06 Section "Finish Carpentry"
4. Division 07 Section "Joint Sealants" for sealant requirements applicable to threshold installation specified in this section.
5. Division 08 Sections:
 - a. "Metal Doors and Frames"
 - b. "Flush Wood Doors"
 - c. "Stile and Rail Wood Doors"
 - d. "Interior Aluminum Doors and Frames"
 - e. "Aluminum-Framed Entrances and Storefronts"
 - f. "Stainless Steel Doors and Frames"
 - g. "Special Function Doors"
 - h. "Entrances"

1.02 REFERENCES

A. UL LLC

1. UL 10B - Fire Test of Door Assemblies
2. UL 10C - Positive Pressure Test of Fire Door Assemblies
3. UL 1784 - Air Leakage Tests of Door Assemblies
4. UL 305 - Panic Hardware

B. DHI - Door and Hardware Institute

1. Sequence and Format for the Hardware Schedule
2. Recommended Locations for Builders Hardware
3. Keying Systems and Nomenclature
4. Installation Guide for Doors and Hardware

C. NFPA – National Fire Protection Association

1. NFPA 80 – 2016 Edition – Standard for Fire Doors and Other Opening Protectives
2. NFPA 101 – Life Safety Code
3. NFPA 105 – Smoke and Draft Control Door Assemblies
4. NFPA 252 – Fire Tests of Door Assemblies

D. ANSI - American National Standards Institute

1. ANSI A117.1 – 2017 Edition – Accessible and Usable Buildings and Facilities
2. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties
3. ANSI/BHMA A156.28 - Recommended Practices for Keying Systems
4. ANSI/WDMA I.S. 1A - Interior Architectural Wood Flush Doors
5. ANSI/SDI A250.8 - Standard Steel Doors and Frames

1.03 SUBMITTALS

A. General:

1. Submit in accordance with Conditions of Contract and Division 01 Submittal Procedures.
2. Prior to forwarding submittal:
 - a. Review drawings and Sections from related trades to verify compatibility with specified hardware.
 - b. Highlight, encircle, or otherwise specifically identify on submittals: deviations from Contract Documents, issues of incompatibility or other issues which may detrimentally affect the Work.

B. Action Submittals:

1. Product Data: Submit 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.
2. Samples for Verification: If requested by Architect, submit production sample of requested door hardware unit in finish indicated and tagged with full description for coordination with schedule.
 - a. Samples will be returned to supplier. Units that are acceptable to Architect may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.
3. Door Hardware Schedule:
 - a. Submit concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate fabrication of other work critical in Project construction schedule.
 - b. Submit under direct supervision of a Door Hardware Institute (DHI) certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule published by DHI.
 - c. Indicate complete designations of each item required for each opening, include:
 - 1) Door Index: door number, heading number, and Architect's hardware set number.
 - 2) Quantity, type, style, function, size, and finish of each hardware item.
 - 3) Name and manufacturer of each item.

- 4) Fastenings and other pertinent information.
- 5) Location of each hardware set cross-referenced to indications on Drawings.
- 6) Explanation of all abbreviations, symbols, and codes contained in schedule.
- 7) Mounting locations for hardware.
- 8) Door and frame sizes and materials.
- 9) Degree of door swing and handing.

4. Key Schedule:

- a. After Keying Conference, provide keying schedule that includes levels of keying, explanations of key system's function, key symbols used, and door numbers controlled.
- b. Use ANSI/BHMA A156.28 "Recommended Practices for Keying Systems" as guideline for nomenclature, definitions, and approach for selecting optimal keying system.
- c. Provide 3 copies of keying schedule for review prepared and detailed in accordance with referenced DHI publication. Include schematic keying diagram and index each key to unique door designations.
- d. Index keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions.
- e. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion. Forward bitting list, key cuts and key system schematic directly to Owner, by means as directed by Owner.
- f. Prepare key schedule by or under supervision of supplier, detailing Owner's final keying instructions for locks.

C. Informational Submittals:

1. Provide Qualification Data for Supplier, Installer and Architectural Hardware Consultant.
2. Provide Product Data:
 - a. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.
 - b. Include warranties for specified door hardware.

D. Closeout Submittals:

1. Operations and Maintenance Data: Provide in accordance with Division 01 and include:
 - a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
 - b. Catalog pages for each product.
 - c. Final approved hardware schedule edited to reflect conditions as installed.
 - d. Final keying schedule
 - e. Copy of warranties including appropriate reference numbers for manufacturers to identify project.

E. Inspection and Testing:

1. Submit written reports to the Owner and Authority Having Jurisdiction (AHJ) of the results of functional testing and inspection for:
 - a. Fire door assemblies, in compliance with NFPA 80.
 - b. Required egress door assemblies, in compliance with NFPA 101.

1.04 QUALITY ASSURANCE

A. Qualifications and Responsibilities:

1. Supplier: Recognized architectural hardware supplier with a minimum of 5 years documented experience supplying both mechanical and electromechanical door hardware similar in quantity, type, and quality to that indicated for this Project. Supplier to be recognized as a factory direct distributor by the manufacturer of the primary materials with a warehousing facility in the Project's vicinity. Supplier to have on staff, a certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) available to Owner, Architect, and Contractor, at reasonable times during the Work for consultation.
2. Installer: Qualified tradesperson skilled in the application of commercial grade hardware with experience installing door hardware similar in quantity, type, and quality as indicated for this Project.
3. Architectural Hardware Consultant: Person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and meets these requirements:
 - a. For door hardware: DHI certified AHC or DHC.
 - b. Can provide installation and technical data to Architect and other related subcontractors.
 - c. Can inspect and verify components are in working order upon completion of installation.
4. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.

B. Certifications:

1. Fire-Rated Door Openings:
 - a. Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction.
 - b. Provide only items of door hardware that are listed products tested by UL LLC, Intertek Testing Services, or other testing and inspecting organizations acceptable to authorities having jurisdiction for use on types and sizes of doors indicated, based on testing at positive pressure and according to NFPA 252 or UL 10C and in compliance with requirements of fire-rated door and door frame labels.
2. Smoke and Draft Control Door Assemblies:
 - a. Provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105
 - b. Comply with the maximum air leakage of 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at tested pressure differential of 0.3-inch wg (75 Pa) of water.
3. Accessibility Requirements:
 - a. Comply with governing accessibility regulations cited in "REFERENCES" article 087100, 1.02.D3 herein for door hardware on doors in an accessible route. This project must comply with all Federal Americans with Disability Act regulations and all Local Accessibility Regulations.

C. Pre-Installation Meetings

1. Keying Conference
 - a. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including:
 - 1) Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
 - 2) Preliminary key system schematic diagram.

3) Address for delivery of keys.

2. Pre-installation Conference

- a. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
- b. Inspect and discuss preparatory work performed by other trades.
- c. Review required testing, inspecting, and certifying procedures.
- d. Review questions or concerns related to proper installation and adjustment of door hardware.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site. Promptly replace products damaged during shipping
- B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package. Deliver each article of hardware in manufacturer's original packaging.
- C. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.
- D. Provide secure lock-up for door hardware delivered to Project. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.
- E. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.
- F. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

1.06 COORDINATION

- A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete.
- B. Installation Templates: Distribute for doors, frames, and other work specified to be factory or shop prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

1.07 WARRANTY

- A. Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within published warranty period.
 1. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.
 2. Warranty Period: Beginning from date of Substantial Completion, for durations indicated in manufacturer's published listings.

- a. Mechanical Warranty
 - 1) Locks
 - a) Schlage L Series: 10 years
 - b) Schlage ND Series: 10 years
 - 2) Exit Devices
 - a) Von Duprin: 10 years
 - 3) Closers
 - a) LCN 4000 Series: 30 years
 - 4) Automatic Operators
 - a) LCN: 2 years

1.08 MAINTENANCE

- A. Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.
- B. Turn over unused materials to Owner for maintenance purposes.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Approval of alternate manufacturers and/or products other than those listed as "Scheduled Manufacturer" or "Acceptable Manufacturers" in the individual article for the product category are only to be considered by official substitution request in accordance with section 01 25 00.
- B. Approval of products from manufacturers indicated in "Acceptable Manufacturers" is contingent upon those products providing all functions and features and meeting all requirements of scheduled manufacturer's product.
- C. Where specified hardware is not adaptable to finished shape or size of members requiring hardware, furnish suitable types having same operation and quality as type specified, subject to Architect's approval.

2.02 MATERIALS

- A. Fabrication
 - 1. Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. provide screws according to manufacturer's recognized installation standards for application intended.
 - 2. Finish exposed screws to match hardware finish, or, if exposed in surfaces of other work, to match finish of this other work including prepared for paint surfaces to receive painted finish.
 - 3. Provide concealed fasteners wherever possible for hardware units exposed when door is closed. Coordinate with "Metal Doors and Frames", "Flush Wood Doors", "Stile and Rail Wood Doors" to ensure proper reinforcements. Advise the Architect where visible fasteners, such as thru bolts, are required.

- B. Provide screws, bolts, expansion shields, drop plates and other devices necessary for hardware installation.
 - 1. Where fasteners are exposed to view: Finish to match adjacent door hardware material.

2.03 HINGES

- A. Manufacturers and Products:
 - 1. Scheduled Manufacturer and Product:
 - a. Ives 5BB series
 - 2. Acceptable Manufacturers and Products:
 - a. McKinney TB series
 - b. Best FBB series
- B. Requirements:
 - 1. Provide hinges conforming to ANSI/BHMA A156.1.
 - 2. Provide five knuckle, ball bearing hinges.
 - 3. 1-3/4 inch (44 mm) thick doors, up to and including 36 inches (914 mm) wide:
 - a. Exterior: Standard weight, bronze or stainless steel, 4-1/2 inches (114 mm) high
 - b. Interior: Standard weight, steel, 4-1/2 inches (114 mm) high
 - 4. 1-3/4 inch (44 mm) thick doors over 36 inches (914 mm) wide:
 - a. Exterior: Heavy weight, bronze/stainless steel, 5 inches (127 mm) high
 - b. Interior: Heavy weight, steel, 5 inches (127 mm) high
 - 5. Adjust hinge width for door, frame, and wall conditions to allow proper degree of opening.
 - 6. Provide three hinges per door leaf for doors 90 inches (2286 mm) or less in height, and one additional hinge for each 30 inches (762 mm) of additional door height.
 - 7. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
 - a. Steel Hinges: Steel pins
 - b. Non-Ferrous Hinges: Stainless steel pins
 - c. Out-Swinging Exterior Doors: Non-removable pins
 - d. Out-Swinging Interior Lockable Doors: Non-removable pins
 - e. Interior Non-lockable Doors: Non-rising pins

2.04 CONTINUOUS HINGES

- A. Manufacturers:
 - 1. Scheduled Manufacturer:
 - a. Ives
 - 2. Acceptable Manufacturers:
 - a. Select
 - b. Best
 - c. Roton
 - d. ABH
- B. Requirements:

1. Provide aluminum geared continuous hinges conforming to ANSI/BHMA A156.26, Grade 1.
2. Provide aluminum geared continuous hinges, where specified in the hardware sets, fabricated from 6063-T6 aluminum.
3. Provide split nylon bearings at each hinge knuckle for quiet, smooth, self-lubricating operation.
4. Provide hinges capable of supporting door weights up to 450 pounds, and successfully tested for 1,500,000 cycles.
5. On fire-rated doors, provide aluminum geared continuous hinges classified for use on rated doors by testing agency acceptable to authority having jurisdiction.
6. Provide hinges 1 inch (25 mm) shorter in length than nominal height of door, unless otherwise noted or door details require shorter length and with symmetrical hole pattern.

2.05 FLUSH BOLTS

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Ives
2. Acceptable Manufacturers:
 - a. Burns
 - b. DCI
 - c. Trimco
 - d. Don-Jo

B. Requirements:

1. Provide automatic, constant latching, and manual flush bolts with forged bronze or stainless-steel face plates, extruded brass levers, and with wrought brass guides and strikes. Provide 12 inch (305 mm) steel or brass rods at doors up to 90 inches (2286 mm) in height. For doors over 90 inches (2286 mm) in height increase top rods by 6 inches (152 mm) for each additional 6 inches (152 mm) of door height. Provide dust-proof strikes at each bottom flush bolt.

2.06 MORTISE LOCKS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
 - a. Schlage L9000 series
2. Acceptable Manufacturers and Products:
 - a. Accurate 9000/9100 series
 - b. Best 45H series

B. Requirements:

1. Provide mortise locks conforming to ANSI/BHMA A156.13 Series 1000, Grade 1, and UL Listed for 3-hour fire doors.
2. Indicators: Where specified, provide indicator window measuring a minimum 2-inch x 1/2 inch with 180-degree visibility. Provide messages color-coded with full text and/or symbols, as scheduled, for easy visibility.

3. Provide locks manufactured from heavy gauge steel, containing components of steel with a zinc dichromate plating for corrosion resistance.
4. Provide lock case that is multi-function and field reversible for handing without opening case. Cylinders: Refer to "KEYING" article, herein.
5. Provide locks with standard 2-3/4 inches (70 mm) backset with full 3/4 inch (19 mm) throw stainless steel mechanical anti-friction latchbolt. Provide deadbolt with full 1-inch (25 mm) throw, constructed of stainless steel.
6. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
7. Lever Trim: Solid brass, bronze, or stainless steel, cast or forged in design specified, with wrought roses and external lever spring cages. Provide thru-bolted levers with 2-piece spindles.

2.07 CYLINDRICAL LOCKS – GRADE 1

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
 - a. Schlage ND series
2. Acceptable Manufacturers and Products:
 - a. Sargent 11-Line
 - b. Corbin-Russwin CL3100 series

B. Requirements:

1. Provide cylindrical locks conforming to ANSI/BHMA A156.2 Series 4000, Grade 1, and UL Listed for 3-hour fire doors.
2. Indicators: Where specified, provide escutcheon with lock status indicator window on top of lockset rose:
 - a. Escutcheon height (including rose) 6.05 inches high by 3.68 inches wide.
 - b. Indicator window measuring a minimum 3.52-inch by .60 inch with 1.92 square-inches of front facing viewing area and 180-degree visibility with a total of .236 square-inches of total viewable area.
 - c. Provide snap-in serviceable window to prevent tampering. Lock must function if indicator is compromised.
 - d. Provide messages color-coded with full text and symbol, as scheduled, for easy visibility.
 - e. Unlocked and Unoccupied message will display on white background, and Locked and Occupied message will display on red background.
3. Cylinders: Refer to "KEYING" article, herein.
4. Provide locks with standard 2-3/4 inches (70 mm) backset, unless noted otherwise, with 1/2-inch latch throw. Provide proper latch throw for UL listing at pairs.
5. Provide locksets with separate anti-rotation thru-bolts, and no exposed screws.
6. Provide independently operating levers with two external return spring cassettes mounted under roses to prevent lever sag.
7. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
8. Lever Trim: Solid cast levers without plastic inserts and wrought roses on both sides.

2.08 DEADBOLTS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
 - a. Schlage B500 Series
2. Acceptable Manufacturers and Products:
 - a. Arrow E Series
 - b. Dormakaba D800/DB600 Series
 - c. Falcon D200 Series

B. Requirements:

1. Provide grade 2 deadbolt series conforming to ANSI/BHMA A156.
2. Cylinders: Refer to "KEYING" article, herein.
3. Provide deadbolts with standard 2-3/4 inches (70 mm) backset. Provide 2-3/8 inches (60 mm) where noted or if door or frame detail requires. Provide deadbolt with full 1-inch (25 mm) throw, constructed of steel alloy.
4. Provide manufacturer's standard strike.
5. Lock Status Indicator Trim: Where specified, provide escutcheon with lock status indicator window.
 - a. Escutcheon height 4.125 inches, width 2.54 inches. Projection 1.32 inches on thumbturn side and 1.28 inches on cylinder side.
 - b. Unlocked and Unoccupied message will display on white background, and Locked and Occupied message will display on red background.
 - c. Provide snap-in serviceable window to prevent tampering. Lock must function if indicator is compromised.
 - d. Indicator window to provide 180-degree visibility.

2.09 EXIT DEVICES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
 - a. Von Duprin 98/35A series
2. Acceptable Manufacturers and Products:
 - a. Detex Advantex series
 - b. Precision APEX 2000 series

B. Requirements:

1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1 and UL listed for Panic Exit or Fire Exit Hardware.
2. Cylinders: Refer to "KEYING" article, herein.
3. Provide smooth touchpad type exit devices, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match balance of door hardware.
4. Touchpad must extend a minimum of one half of door width. No plastic inserts are allowed in touchpads.
5. Provide exit devices with weather resistant components that can withstand harsh conditions of various climates and corrosive cleaners used in outdoor pool environments.
6. Provide flush end caps for exit devices.
7. Provide exit devices with manufacturer's approved strikes.
8. Provide exit devices cut to door width and height. Install exit devices at height recommended by exit device manufacturer, allowable by governing building codes, and approved by Architect.

9. Mount mechanism case flush on face of doors or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.
10. Provide cylinder or hex-key dogging as specified at non fire-rated openings.
11. Removable Mullions: 2 inches (51 mm) x 3 inches (76 mm) steel tube. Where scheduled as keyed removable mullion, provide type that can be removed by use of a keyed cylinder, which is self-locking when re-installed.
12. Provide factory drilled weep holes for exit devices used in full exterior application, highly corrosive areas, and where noted in hardware sets.
13. Top latch mounting: double- or single-tab mount for steel doors, face mount for aluminum doors eliminating requirement of tabs, and double tab mount for wood doors.
14. Provide exit devices with optional trim designs to match other lever and pull designs used on the project.

2.10 CYLINDERS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
 - a. Schlage Everest 29 S
2. Acceptable Manufacturers and Products:
 - a. Best Preferred Patented
 - b. Yale Keymark

B. Requirements:

1. Provide cylinders/cores compliant with ANSI/BHMA A156.5; latest revision; cylinder face finished to match lockset; manufacturer's series as indicated. Refer to "KEYING" article, herein.
2. Provide cylinders in the below-listed configuration(s), distributed throughout the Project as indicated.
 - a. Patented Open: cylinder with interchangeable core with open keyway.
3. Patent Protection: Cylinders/cores requiring use of restricted, patented keys, patent protected.
4. Nickel silver bottom pins.

2.11 KEYING

A. Scheduled System:

1. New factory registered system:
 - a. Provide a factory registered keying system, complying with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.

B. Requirements:

1. Construction Keying:
 - a. Replaceable Construction Cores.
 - 1) Provide temporary construction cores replaceable by permanent cores, furnished in accordance with the following requirements.
 - a) 3 construction control keys

- b) 12 construction change (day) keys.
 - 2) Owner or Owner's Representative will replace temporary construction cores with permanent cores.
2. Permanent Keying:
- a. Provide permanent cylinders/cores keyed by the manufacturer according to the following key system.
 - 1) Master Keying system as directed by the Owner.
 - b. Forward biting list and keys separately from cylinders, by means as directed by Owner. Failure to comply with forwarding requirements will be cause for replacement of cylinders/cores involved at no additional cost to Owner.
 - c. Provide keys with the following features:
 - 1) Material: Nickel silver; minimum thickness of .107-inch (2.3mm)
 - 2) Patent Protection: Keys and blanks protected by one or more utility patent(s).
 - d. Identification:
 - 1) Mark permanent cylinders/cores and keys with applicable blind code for identification. Do not provide blind code marks with actual key cuts.
 - 2) Identification stamping provisions must be approved by the Architect and Owner.
 - 3) Stamp cylinders/cores and keys with Owner's unique key system facility code as established by the manufacturer; key symbol and embossed or stamped with "DO NOT DUPLICATE" along with the "PATENTED" or patent number to enforce the patent protection.
 - 4) Failure to comply with stamping requirements will be cause for replacement of keys involved at no additional cost to Owner.
 - 5) Forward permanent cylinders/cores to Owner, separately from keys, by means as directed by Owner.
 - e. Quantity: Furnish in the following quantities.
 - 1) Permanent Control Keys: 3.
 - 2) Master Keys: 6.
 - 3) Change (Day) Keys: 3 per cylinder/core that is keyed differently
 - 4) Key Blanks: Quantity as determined in the keying meeting.

2.12 DOOR CLOSERS

A. Manufacturers and Products:

- 1. Scheduled Manufacturer and Product:
 - a. LCN 4010/4110/4020 series
- 2. Acceptable Manufacturers and Products:
 - a. Corbin-Russwin DC8000 series
 - b. Sargent 281 series

B. Requirements:

- 1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. Certify surface mounted mechanical closers to meet fifteen million (15,000,000) full load cycles. ISO 9000 certify closers. Stamp units with date of manufacture code.
- 2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.
- 3. Cylinder Body: 1-1/2-inch (38 mm) diameter with 11/16-inch (17 mm) diameter double heat-treated pinion journal.

4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck.
7. Provide closers with solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers. When closers are parallel arm mounted, provide closers which mount within 6-inch (152 mm) top rail without use of mounting plate so that closer is not visible through vision panel from pull side.
8. Pressure Relief Valve (PRV) Technology: Not permitted.
9. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers: Powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI/BHMA Standard A156.4 and ASTM B117, or has special rust inhibitor (SRI).
10. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

2.13 ELECTROMECHANICAL AUTOMATIC OPERATORS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
 - a. LCN Senior Swing
2. Acceptable Manufacturers and Products:
 - a. Besam Swingmaster MP
 - b. Horton 4000LE series
 - c. Stanley Access Technologies M-Force

B. Requirements:

1. Provide low energy automatic operator units that are electromechanical design complying with ANSI/BHMA A156.19.
 - a. Opening: Powered by DC motor working through reduction gears.
 - b. Closing: Spring force.
 - c. Manual, hydraulic, or chain drive closers: Not permitted.
 - d. Operation: Motor is off when door is in closing mode. Door can be manually operated with power on or off without damage to operator. Provide variable adjustments, including opening and closing speed adjustment.
 - e. Cover: Aluminum.
2. Provide units with manual off/auto/hold-open switch, push and go function to activate power operator, vestibule interface delay, electric lock delay, hold-open delay adjustable from 1 to 32 seconds, and logic terminal to interface with accessories, mats, and sensors.
3. Provide drop plates, brackets, and adapters for arms as required to suit details.
4. Provide motion sensors and/or actuator switches, and receivers for operation as specified. Provide weather-resistant actuators at exterior applications.
5. Provide key switches, with LED's, recommended and approved by manufacturer of automatic operator as required for function as described in operation description of hardware sets. Cylinders: Refer to "KEYING" article, herein.

6. Provide complete assemblies of controls, switches, power supplies, relays, and parts/material recommended and approved by manufacturer of automatic operator for each individual leaf. Actuators control both doors simultaneously at pairs. Sequence operation of exterior and vestibule doors with automatic operators to allow ingress or egress through both sets of openings as directed by Architect. Locate actuators, key switches, and other controls as directed by Architect.

2.14 DOOR TRIM

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Ives
2. Acceptable Manufacturers:
 - a. Elmes
 - b. Burns
 - c. Trimco

B. Requirements:

1. Provide push plates, push bars, pull plates, pulls, and hands-free reversible door pulls with diameter and length as scheduled.

2.15 PROTECTION PLATES

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Ives
2. Acceptable Manufacturers:
 - a. Burns
 - b. Trimco

B. Requirements:

1. Provide protection plates with a minimum of 0.050 inch (1 mm) thick, beveled four edges as scheduled. Furnish with sheet metal or wood screws, finished to match plates.
2. Sizes plates 2 inches (51 mm) less width of door on single doors, pairs of doors with a mullion, and doors with edge guards. Size plates 1 inch (25 mm) less width of door on pairs without a mullion or edge guards.
3. At fire rated doors, provide protection plates over 16 inches high with UL label.

2.16 OVERHEAD STOPS AND OVERHEAD STOP/HOLDERS

A. Manufacturers:

1. Scheduled Manufacturers:
 - a. Glynn-Johnson
2. Acceptable Manufacturers:

- a. Rixson
- b. Sargent
- c. ABH

B. Requirements:

- 1. Provide overhead stop at any door where conditions do not allow for a wall stop or floor stop presents tripping hazard.

2.17 DOOR STOPS AND HOLDERS

A. Manufacturers:

- 1. Scheduled Manufacturer:
 - a. Ives
- 2. Acceptable Manufacturers:
 - a. Burns
 - b. Trimco
 - c. Rockwood

B. Provide door stops at each door leaf:

- 1. Provide wall stops wherever possible. Provide concave type where lockset has a push button of thumbturn.
- 2. Where a wall stop cannot be used, provide universal floor stops.
- 3. Where wall or floor stop cannot be used, provide overhead stop.
- 4. Provide roller bumper where doors open into each other and overhead stop cannot be used.

2.18 THRESHOLDS, SEALS, DOOR SWEEPS, AUTOMATIC DOOR BOTTOMS, AND GASKETING

A. Manufacturers:

- 1. Scheduled Manufacturer:
 - a. Zero International
- 2. Acceptable Manufacturers:
 - a. National Guard
 - b. Reese
 - c. DHSI
 - d. Legacy
 - e. Pemko

B. Requirements:

- 1. Provide thresholds, weather-stripping, and gasketing systems as specified and per architectural details. Match finish of other items.
- 2. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.

3. Provide door sweeps, seals, astragals, and auto door bottoms only of type where resilient or flexible seal strip is easily replaceable and readily available.
4. Size thresholds 1/2 inch (13 mm) high by 5 inches (127 mm) wide by door width unless otherwise specified in the hardware sets or detailed in the drawings.

2.19 SILENCERS

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Ives
2. Acceptable Manufacturers:
 - a. Burns
 - b. Rockwood
 - c. Trimco

B. Requirements:

1. Provide "push-in" type silencers for hollow metal or wood frames.
2. Provide one silencer per 30 inches (762 mm) of height on each single frame, and two for each pair frame.
3. Omit where gasketing is specified.

2.20 FINISHES

A. FINISH: BHMA 626/652 (US26D); EXCEPT:

1. Hinges at Exterior Doors: BHMA 630 (US32D)
2. Aluminum Geared Continuous Hinges: BHMA 628 (US28)
3. Push Plates, Pulls, and Push Bars: BHMA 630 (US32D)
4. Protection Plates: BHMA 630 (US32D)
5. Overhead Stops and Holders: BHMA 630 (US32D)
6. Door Closers: Powder Coat to Match
7. Wall Stops: BHMA 630 (US32D)
8. Latch Protectors: BHMA 630 (US32D)
9. Weatherstripping: Clear Anodized Aluminum
10. Thresholds: Mill Finish Aluminum

B. FINISH: BHMA 643E/716 (US11); EXCEPT:

1. Door Closers: Powder Coat to Match.
2. Weatherstripping: Dark Bronze Anodized Aluminum.
3. Thresholds: Extruded Architectural Bronze, Oil-Rubbed

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Prior to installation of hardware, examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance. Verify doors, frames, and walls have been properly reinforced for hardware installation.
- B. Submit a list of deficiencies in writing and proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Mount door hardware units at heights to comply with the following, unless otherwise indicated or required to comply with governing regulations.
 - 1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
 - 2. Custom Steel Doors and Frames: HMMA 831.
 - 3. Interior Architectural Wood Flush Doors: ANSI/WDMA I.S. 1A
 - 4. Installation Guide for Doors and Hardware: DHI TDH-007-20
- B. Install door hardware in accordance with NFPA 80, NFPA 101 and provide post-install inspection, testing as specified in section 1.03.E unless otherwise required to comply with governing regulations.
- C. Install each hardware item in compliance with manufacturer's instructions and recommendations, using only fasteners provided by manufacturer.
- D. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.
- E. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.
- F. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- G. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.
- H. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated.
- I. Lock Cylinders:
 - 1. Install construction cores to secure building and areas during construction period.
 - 2. Replace construction cores with permanent cores as indicated in keying section.
- J. Continuous Hinges: Re-locate the door and frame fire rating labels where they will remain visible so that the hinge does not cover the label once installed.
- K. Door Closers & Auto Operators: Mount closers/operators on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Mount closers/operators so they are not visible in corridors, lobbies and other public spaces unless approved by Architect.

- L. Overhead Stops/Holders: Mount overhead stops/holders on room side of corridor doors, inside of exterior doors, and stair side of stairway doors.
- M. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."
- N. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they may impede traffic or present tripping hazard.
- O. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
- P. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
- Q. Door Bottoms and Sweeps: Apply to bottom of door, forming seal with threshold when door is closed.

3.03 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
 - 1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
- B. Occupancy Adjustment: Approximately three to six months after date of Substantial Completion, examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors and door hardware.

3.04 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items per manufacturer's instructions to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.05 DOOR HARDWARE SCHEDULE

- A. The intent of the hardware specification is to specify the hardware for interior and exterior doors, and to establish a type, continuity, and standard of quality. However, it is the door hardware supplier's responsibility to thoroughly review existing conditions, schedules, specifications, drawings, and other Contract Documents to verify the suitability of the hardware specified.

- B. Discrepancies, conflicting hardware, and missing items are to be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application.
- C. Hardware items are referenced in the following hardware schedule. Refer to the above specifications for special features, options, cylinders/keying, and other requirements.
- D. Hardware Sets:

137180 X-124526 Version 3

Hardware Group No. HW-01

For use on Door #(s):

100

Provide each door(s) with the following:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA CONT. HINGE	112XY	710	IVE
1	EA PANIC HARDWARE	CD-9849-EO	643E	VON
1	EA PANIC HARDWARE	CD-9849-NL-OP-110MD	643E	VON
1	EA RIM CYLINDER	20-057 ICX	643e	SCH
2	EA MORTISE CYLINDER	20-061 X XQ11-948 36-083	643e	SCH
1	EA FSIC CORE	23-030 EV29 S	613	SCH
2	EA LONG DOOR PULL	9264F 24" STD	613	IVE
1	EA SURFACE CLOSER	4111 SCUSH	695	LCN
1	EA SURF. AUTO OPERATOR	9542IQ REG	630	LCN
2	EA ACTUATOR, TOUCH	8310-853T	630	LCN
1	WEATHERSTRIPPING	BY DOOR MANUFACTURER		
2	EA DOOR SWEEP	39D	D	ZER
1	EA THRESHOLD	655D-223	D	ZER

Hardware Group No. HW-02

For use on Door #(s):

100A 100B 107 125C 206 210

Provide each door(s) with the following:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA STOREROOM LOCK	ND80TD LAT	626	SCH
1	EA FSIC CORE	23-030 EV29 S	626	SCH
1	EA WALL STOP	WS406/407CCV	630	IVE
3	EA SILENCER	SR64/65 AS REQ	GRY	IVE

Hardware Group No. HW-03

For use on Door #(s):

101

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	EA	CONT. HINGE	112XY		710	IVE
2	EA	DUMMY PUSH BAR	350		643E	VON
2	EA	LONG DOOR PULL	9264F 24" STD		613	IVE
1	EA	SURFACE CLOSER	4111 SCUSH		695	LCN
1	EA	SURF. AUTO OPERATOR	9542 AS REQ (120/240 VAC)		✓ ANDK B	LCN
2	EA	ACTUATOR, TOUCH	8310-853T		✓ 630	LCN

Hardware Group No. HW-04

For use on Door #(s):

104A

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		630	IVE
1	EA	STOREROOM LOCK	L9080T LATA		626	SCH
1	EA	FSIC CORE	23-030 EV29 S		626	SCH
1	EA	SURFACE CLOSER	4111 SCUSH		695	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	GASKETING	188SBK PSA		BK	ZER
1	EA	DOOR SWEEP	39A		A	ZER
1	EA	THRESHOLD	655A-223		A	ZER

Hardware Group No. HW-05

For use on Door #(s):

105A 105B

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		630	IVE
1	EA	REMOVABLE MULLION	KR4954		689	VON
1	EA	PANIC HARDWARE	CD-98-NL		626	VON
1	EA	PANIC HARDWARE	LD-98-EO		626	VON
1	EA	RIM CYLINDER	20-057 ICX		626	SCH
1	EA	MORTISE CYLINDER	20-061 X XQ11-948 36-083		626	SCH
1	EA	FSIC CORE	23-030 EV29 S		626	SCH
2	EA	SURFACE CLOSER	4111 SCUSH		695	LCN
1	EA	GASKETING	188SBK PSA		BK	ZER
2	EA	DOOR SWEEP	39A		A	ZER
1	EA	THRESHOLD	655A-223		A	ZER

Hardware Group No. HW-06

For use on Door #(s):

108 109 110

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	PRIVACY LOCK W/ OUTSIDE INDICATOR	ND40S LAT OS-LOC		626	SCH
1	EA	SURFACE CLOSER	4011		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
3	EA	SILENCER	SR64/65 AS REQ		GRY	IVE

Hardware Group No. HW-07

For use on Door #(s):

111 112B 115A

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5		652	IVE
1	EA	DBL CYL DEADBOLT	B562R		626	SCH
1	EA	PUSH PLATE	8300 10" 4" X 16"		630	IVE
1	EA	PULL PLATE	8302 10" 4" X 16"		630	IVE
1	EA	SURFACE CLOSER	4111 SCUSH		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	GASKETING	188SBK PSA		BK	ZER
1	EA	DOOR BOTTOM	360AA		AA	ZER
1	EA	THRESHOLD	655A-223		A	ZER

Hardware Group No. HW-08

For use on Door #(s):

112A 113A 123

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	112XY		710	IVE
1	EA	PANIC HARDWARE	CD-98-NL		643E	VON
1	EA	RIM CYLINDER	20-057 ICX		643e	SCH
1	EA	MORTISE CYLINDER	20-061 X XQ11-948 36-083		643e	SCH
1	EA	FSIC CORE	23-030 EV29 S		613	SCH
1	EA	LONG DOOR PULL	9264F 24" STD		613	IVE
1	EA	SURFACE CLOSER	4111 SCUSH		695	LCN
1		WEATHERSTRIPPING	BY DOOR MANUFACTURER			
1	EA	DOOR SWEEP	39D		D	ZER
1	EA	THRESHOLD	655D-223		D	ZER

Hardware Group No. HW-09

For use on Door #(s):

112C

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	112XY		710	IVE
1	EA	PANIC HARDWARE	CD-98-NL		643E	VON
1	EA	RIM CYLINDER	20-057 ICX		643e	SCH
1	EA	MORTISE CYLINDER	20-061 X XQ11-948 36-083		643e	SCH
1	EA	FSIC CORE	23-030 EV29 S		613	SCH
1	EA	SURFACE CLOSER	4111 EDA		695	LCN
1	EA	WALL STOP	WS406/407CCV		643E/7 16	IVE

Hardware Group No. HW-10

For use on Door #(s):

112D 125B 125A

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	HARDWARE	BY DOOR MANUFACTURER			

Hardware Group No. HW-11

For use on Door #(s):

113

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	STOREROOM LOCK	ND80TD LAT		626	SCH
1	EA	FSIC CORE	23-030 EV29 S		626	SCH
1		OH STOP	450S		652	GLY
3	EA	SILENCER	SR64/65 AS REQ		GRY	IVE

Hardware Group No. HW-12

For use on Door #(s):

114

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	MANUAL FLUSH BOLT	FB358/FB458 AS REQ		626	IVE
1	EA	CLASSROOM LOCK	ND70TD LAT		626	SCH
1	EA	FSIC CORE	23-030 EV29 S		626	SCH
2	EA	WALL STOP	WS406/407CCV		630	IVE
2	EA	SILENCER	SR64/65 AS REQ		GRY	IVE

Hardware Group No. HW-13

For use on Door #(s):

115

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	CLASSROOM LOCK	ND70TD LAT		626	SCH
1	EA	FSIC CORE	23-030 EV29 S		626	SCH
1	EA	WALL STOP	WS406/407CCV		630	IVE
3	EA	SILENCER	SR64/65 AS REQ		GRY	IVE

Hardware Group No. HW-14

For use on Door #(s):

115B

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		630	IVE
1	EA	PANIC HARDWARE	CD-98-NL		626	VON
1	EA	RIM CYLINDER	20-057 ICX		626	SCH
1	EA	MORTISE CYLINDER	20-061 X XQ11-948 36-083		626	SCH
1	EA	FSIC CORE	23-030 EV29 S		626	SCH
1	EA	SURFACE CLOSER	4111 SCUSH		695	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	GASKETING	188SBK PSA		BK	ZER
1	EA	DOOR SWEEP	39A		A	ZER
1	EA	THRESHOLD	655A-223		A	ZER

Hardware Group No. HW-15

For use on Door #(s):

116

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	CLASSROOM LOCK	ND70TD LAT		626	SCH
1	EA	FSIC CORE	23-030 EV29 S		626	SCH
1		OH STOP	450S		652	GLY
3	EA	SILENCER	SR64/65 AS REQ		GRY	IVE

Hardware Group No. HW-16

For use on Door #(s):

119 120

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	MANUAL FLUSH BOLT	FB358/FB458 AS REQ		626	IVE
1	EA	ENTRANCE/OFFICE LOCK W/ OUTSIDE INDICATOR	ND50TD LAT OS-LOC		626	SCH
1	EA	FSIC CORE	23-030 EV29 S		626	SCH
2	EA	WALL STOP	WS406/407CCV		630	IVE
2	EA	SILENCER	SR64/65 AS REQ		GRY	IVE

Hardware Group No. HW-17

For use on Door #(s):

121 122

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5		652	IVE
1	EA	PUSH PLATE	8300 10" 4" X 16"		630	IVE
1	EA	PULL PLATE	8302 10" 4" X 16"		630	IVE
1	EA	SURFACE CLOSER	4111 EDA		689	LCN
1	EA	WALL STOP	WS406/407CCV		630	IVE
3	EA	SILENCER	SR64/65 AS REQ		GRY	IVE

Hardware Group No. HW-18

For use on Door #(s):

124

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
8	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	MANUAL FLUSH BOLT	FB358/FB458 AS REQ		626	IVE
1	EA	STOREROOM LOCK	ND80TD LAT		626	SCH
1	EA	FSIC CORE	23-030 EV29 S		626	SCH
2	EA	WALL STOP	WS406/407CCV		630	IVE
2	EA	SILENCER	SR64/65 AS REQ		GRY	IVE

Hardware Group No. HW-19

For use on Door #(s):

204D

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	PANIC HARDWARE	LD-98-NL		626	VON
1	EA	RIM CYLINDER	20-057 ICX		626	SCH
1	EA	FSIC CORE	23-030 EV29 S		626	SCH
1	EA	SURFACE CLOSER	4111 EDA		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
3	EA	SILENCER	SR64/65 AS REQ		GRY	IVE

Hardware Group No. HW-20

For use on Door #(s):

S1A

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	PANIC HARDWARE	LD-98-L-LAT		626	VON
1	EA	RIM CYLINDER	20-057 ICX		626	SCH
1	EA	FSIC CORE	23-030 EV29 S		626	SCH
1	EA	SURFACE CLOSER	4111 SCUSH		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
3	EA	SILENCER	SR64/65 AS REQ		GRY	IVE

Hardware Group No. HW-21

For use on Door #(s):
S1B

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	PANIC HARDWARE	LD-98-L-BE-LAT		626	VON
1	EA	RIM CYLINDER	20-057 ICX		626	SCH
1	EA	FSIC CORE	23-030 EV29 S		626	SCH
1	EA	SURFACE CLOSER	4111 EDA		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
3	EA	SILENCER	SR64/65 AS REQ		GRY	IVE

END OF SECTION

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SECTION 08 80 00 - GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES:

- A. Provide labor, material, services and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
 - 1. Window units.
 - 2. Storefront systems
 - 3. Door vision lites.

1.3 REFERENCE STANDARDS

- A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Current Edition.
- B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test; 2015 (Reaffirmed 2020).
- C. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.
- D. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2019).
- E. ASTM C1036 - Standard Specification for Flat Glass; 2021.
- F. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.
- G. ASTM C1115 - Standard Specification for Dense Elastomeric Silicone Rubber Gaskets and Accessories; 2017 (Reapproved 2022).
- H. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass; 2021a.
- I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
- J. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2024.
- K. ASTM E2188 - Standard Test Method for Insulating Glass Unit Performance; 2019.
- L. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation; 2019.
- M. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2022.
- N. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2022.
- O. NFPA 257 - Standard on Fire Test for Window and Glass Block Assemblies; 2022.
- P. ASTM E283 - Standard Test Method For Determining Rate of Air leakage Through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Differences Across the Specimen
- Q. ASTM E2025 - Standard Test Method for Evaluating Fenestration Components and Assemblies for Resistance to Impact Energies
- R. CPSC 16 CFR 1201 Safety Standards for Architectural Glazing Materials
- S. GANA - Glazing Manual
- T. FGMA - Sealant Manual

- U. LSGA – LSGA Design Guide”
- V. SIGMA – TM-3000 “Vertical Glazing Guidelines” and TB-3001 “Sloped Glazing Guidelines”
- W. SGCC – Safety Glazing Certification Council

1.4 REFERENCES

- A. Refer to specification Section 01 41 00 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 ACTION SUBMITTALS

- A. See Section 01 30 00 – Administrative Requirements and Section 01 60 00 – Product Requirements for submittal procedures.
- B. Product Data: For each glass product and glazing material indicated.
- C. Shop Drawings: Glazing Schedule of all openings indicating glass type, thickness, opening size and location. Schedule shall be submitted with shop drawings.
- D. Samples: 12-inch-square samples of each type of glass indicated, and 12-inch-long samples of each color required for each type of sealant or gasket exposed to view. Install sealant or gasket sample between two strips of material representative in color of the adjoining framing system.
 - 1. Provide 3 samples of sandblast glass patterns/variations available for approval by the Architect.
- E. Product Certificates: Signed by glazing materials manufacturers certifying that their products comply with specified requirements.
- F. Compatibility and Adhesion Test Reports: From sealant manufacturer indicating that glazing materials were tested for compatibility and adhesion with glazing sealants. Include sealant manufacturer's interpretation of test results relative to sealant performance and recommendations for primers and substrate preparation needed for adhesion.
- G. Product Test Reports: For each type of glazing sealant and gasket indicated, evidencing compliance with requirements specified.
- H. Maintenance data for glass and other glazing materials to include in Operating and Maintenance Manual specified in Division 01.
- I. Draft Warranties.
- J. Exterior Product Approvals: Manufacturer shall submit documentation that product complies with and has been tested and approved in compliance with Florida Product Approval and applicable requirements.

1.6 QUALITY ASSURANCE

- A. Comply with applicable codes and regulations and with the Consumer Product Safety Commission CPSC 16 CFR 1201 and with applicable recommendations of Flat Glass Marketing Association (FGMA) "Glazing Manual."
- B. Provide labels showing glass manufacturer's identity, type of glass, thickness, and quality. Labels shall remain on glass until it has been set.
 - 1. All clear tempered safety glass and fire rated glazing must have permanently affixed labels for verification.
 - 2. Safety glass mirrors must have permanently affixed labels for verification.
- C. Contractor Qualifications: Employ only experienced Contractors (installers) skilled in the successful installation of the specified materials and assemblies on similar projects for a minimum of five (5) years. Installers shall be state-certified or licensed Sub-Contractors, or locally registered Sub-Contractors in Alachua County, Florida.
- D. Manufacturer Qualifications: Provide products from only manufacturers with at least five (5) years experience making the specified materials as a current catalog and regular production item.

- E. Single-Source Responsibility for Glass: Obtain glass from one source for each product indicated below:
 - 1. Primary glass of each ((ASTM C1036))) type and class indicated.
- F. Single-Source Responsibility for Glazing Accessories: Obtain glazing accessories from one source for each product and installation method indicated.
- G. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
- H. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction or the manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, quality and safety glazing standard with which glass complies.
- I. Comply with applicable codes and regulations and with the Consumer Product Safety Commission CPSC 16 CFR 1201 and with applicable recommendations of Flat Glass Marketing Association (FGMA) "Glazing Manual."
- J. Manufacturer shall certify that product complies with large and small missile impact criteria and has been tested and approved in compliance with Florida Product Approval or Miami Dade NOA and applicable requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver glass to site in suitable containers that will protect glass from the weather and from breakage. Carefully store material, as directed, in a safe place where breakage can be reduced to a minimum. Deliver sufficient glass to allow for normal breakage. Glazing compounds shall arrive at the project site in labeled containers which have not been opened.
- B. Protect glazing materials to comply with manufacturer's directions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
- C. Protect glass edges from damage during handling and installation. Damaged glass is defined as glass with edge damage or other imperfections that could weaken the glass and impair performance and/or appearance if installed.
 - 1. Remove damaged glass and legally dispose of offsite.

1.8 FIELD CONDITIONS

- A. Environmental Conditions: Do not proceed with glazing when ambient and substrate temperature conditions are outside the limits permitted by glazing materials manufacturer or when glazing channel substrates are wet from rain, frost, condensation, or other causes.
 - 1. Install liquid sealants at ambient and substrate temperatures above 40 degrees Fahrenheit (4.44 degrees Celsius).

1.9 WARRANTY

- A. Warranties specified in this Article 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 Contractor under requirements of the Contract Documents.
- B. Manufacturer's Fire Glass Warranty: Submit manufacturer's standard warranty but not less than five (5) years from Date of Substantial Completion.
- C. Manufacturer's Special Warranty: All coated glass products shall be warranted against defects in materials and/or workmanship for a warranty period of ten (10) years from Date of Substantial Completion.

1.10 PERFORMANCE REQUIREMENTS

- A. Provide glazing systems that are produced, fabricated, and installed to withstand normal thermal movement, wind loading, and impact loading (where applicable), without failure including loss or

glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; and other defects in construction.

- B. Glass Design: Glass thicknesses indicated on Drawings are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites for the various size openings in the thicknesses and strengths (annealed or heat-treated) to meet or exceed the following criteria:
 - 1. Minimum glass thickness, nominally, of lites in exterior walls is 6.0 mm (0.23 inch (5.84 mm)).
 - 2. Tinted and heat-absorbing glass thicknesses for each tint indicated are the same throughout Project.
 - 3. Minimum glass thicknesses of lites, whether composed of annealed or heat-treated glass, are selected so the worst-case probability of failure does not exceed the following:
 - a. 8 lites per 1000 for lites set vertically or not over 15 degrees off vertical and under wind action. Determine minimum thickness of monolithic annealed glass according to ASTM E1300. For other than monolithic annealed glass, determine thickness per glass manufacturer's standard method of analysis including applying adjustment factors to ASTM E1300 based on type of glass.
 - b. 1 lite per 1000 for lites set over 15 degrees off vertical and under action of wind.
- C. Normal thermal movement results from the following maximum change (range) in ambient and surface temperatures acting on glass-framing members and glazing components. Base engineering calculation on materials' actual surface temperatures due to both solar heat gain and nighttime sky heat loss.
 - 1. Temperature Change (Range): 120 degrees Fahrenheit (48.89 degrees Celsius), ambient; 180 degrees Fahrenheit (82.22 degrees Celsius), material surfaces.
- D. Specific hazardous locations: The following shall be considered specific hazardous locations for purposes of glazing.
 - 1. Glazing in ingress and means of egress doors.
 - 2. Glazing adjacent to a door and within the same wall plane as the door whose nearest vertical edge is within 24 inches (609.6 mm) of the door in a closed position and whose bottom edge is less than 60 inches (1524 mm) above the floor or walking surface, unless an intervening interior permanent wall is between the door and the glazing.
 - 3. Glazing in fixed panels having a glazed area in excess of 9 sq feet (0.00969 sq cm) with the lowest edge less than 18 inches (457.2 mm) above the finish floor level or walking surface within 36 inches (914.4 mm) of such glazing, unless a horizontal member not less than 1-1/2 inches (38 mm) in width is located between 24 inches (609.6 mm) and 36 inches (914.4 mm) above the walking surface.
- E. Exterior Product Approvals: Manufacturer shall certify that product complies with and has been tested and approved in compliance with Florida Product Approval and applicable requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturer shall be the following in each category however products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product and acceptance is provided by the Architect in writing prior to bidding.
- B. Primary Glass:
 - 1. Guardian.
- C. Architectural Glass Fabricators: Provide products from one of the following:
 - 1. All of the above primary glass manufacturers.
 - 2. Globe-Amerada Glass
 - 3. Interpane High-Performance Glass Products

4. Tempglass
5. Viracon
6. Arch Amarlite

2.2 GLASS TYPES AND USAGE

- A. Glazing for all exterior storefront doors and exterior door lites:
 1. Double Sputter-Coated Insulating Glass Units:
 - a. Conformance: ASTM E2190.
 - b. Outboard Lite: Sputter-coated Guardian Clear Glass (North America) glass.
 - 1) Guardian Clear Glass (North America) Glass: ASTM C1036, Type 1, Class 1, Quality q3.
 - 2) Vacuum Deposition Sputtered Coating: ASTM C1376.
 - c. Coating on Surface No. 2: Guardian No. 2: SunGuard® SNX 70+ (North America).
 - 1) Glass Thickness: 1/4" (6mm).
 - 2) Heat Treatment: None as necessary to meet applicable codes and performance requirements.
 - d. Air Space: 1/2" (12.7mm) wide, hermetically sealed, dehydrated 10% Air, 90% Argon space.
 - e. Inboard Lite: Guardian Clear Glass (North America) glass.
 - 1) Guardian Clear Glass (North America) Glass: ASTM C1036, Type 1, Class 1, Quality q3.
 - 2) Glass Thickness: 1/4" (6mm).
 - 3) Coating on Surface No. 4: Guardian no coating
 - 4) Heat-Treatment: None as necessary to meet applicable codes and performance requirements.
 - f. Glass Unit Performance Characteristics:
 - 1) Visible Light Transmittance: 66
 - 2) Visible Light Reflectance Outdoors: 14
 - 3) Winter U-Value Nighttime: 0.237
 - 4) Summer U-Value Daytime: 0.207
 - 5) Solar Heat Gain Coefficient: 0.27
 - g. Edge Seals: ASTM E2188, with aluminum spacers, dual-sealed with a primary seal of polyisobutylene and a secondary seal of silicone sealant for glass-to-spacer seals.
 - h. Sealant: Approved by glass manufacturers.
 - B. Interior:
 1. Glass for Vestibule Doors, Sidelights, and Transoms: 1/4 inch (6.35 mm) thick clear tempered glass.
 2. Glass for Interior Non-Fire Rated Doors and Windows: 1/4 inch (6.35 mm) clear tempered safety glass.

2.3 PRIMARY GLASS PRODUCTS

- A. Clear Annealed Float Glass: ASTM C1036, Type I, Class 1 (clear), Quality-Q3.
- B. Tinted Annealed Float Glass: ASTM C1036, Type I, Class 2 (tinted), Quality-Q3.
- C. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
- D. Heat-Strengthened Float Glass: ASTM C1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

- E. Pyrolytic-Coated, Low-Maintenance Glass: Clear float glass with a coating on first surface having both photocatalytic and hydrophilic properties that act to loosen dirt and to cause water to sheet evenly over the glass instead of beading.
- F. Refer to requirements for glass units for performance characteristics of assembled units composed of tinted glass, uncoated, relative to visible light transmittance, U-values, shading coefficient, and visible reflectance.

2.4 HEAT-TREATED FLOAT GLASS

- A. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed, unless otherwise indicated.
- B. Uncoated, Clear, Heat-Treated Float Glass: ASTM C1048, Condition A (uncoated surfaces), Type I (transparent glass, flat), Class 1 (clear), Quality q3 (glazing select), kind FT (fully tempered) at all locations.
- C. Uncoated, Tinted, Heat-Treated Float Glass: ASTM C1048, Condition A (uncoated surfaces), Type I (transparent glass, flat), Class 2 (tinted heat-absorbing and light-reducing), Quality q3 (glazing select), with tint color and performance characteristics for 6.0-mm-thick (0.23-inch-thick) glass matching those indicated for annealed primary tinted float glass; kind FT (fully tempered) at all locations.
- D. Coated, Clear, Heat-Treated Float Glass: ASTM C1048, Condition C (other coated glass), Type I (transparent glass, flat), Class 1 (clear), Quality q3 (glazing select), with coating type and performance characteristics complying with requirements specified under coated glass products; kind FT (fully tempered) at all locations.

2.5 ELASTOMERIC GLAZING SEALANTS

- A. General: Provide materials as recommended by the manufacturer for the required application and condition of installation in each case. Provide only compounds which are proven to be fully compatible with surfaces contacted.
- B. Silicone Rubber Glazing Sealant: Shall be silicon rubber, one-part elastomeric sealant complying with FS TT-S-001543, Class A. Provide acid type for nonporous channel surfaces and provide nonacid medium-modulus type for porous channel surfaces.
- C. Preformed Butyl Rubber Glazing Sealant: Shall be tape or ribbon (coiled on release paper) of polymerized butyl or mixture of butyl and polyisobutylene, compounded with inert fillers and pigments, solvent-based with minimum of 95 percent solids with thread or fabric reinforcement, tack-free within 24 hours, paintable, non-staining.
 - 1. Provide combination tape and encased continuous rubber shim of approximately 50 durometer hardness.
- D. Glazing Sealant for Fire-Resistant Glazing Products: Identical to product used in test assembly to obtain fire-resistive rating.

2.6 GLAZING GASKETS

- A. Lock-Strip Gaskets: Neoprene extrusions in size and shape indicated, fabricated into frames with molded corner units and zipper lock strips, complying with ASTM C542, black.
- B. Dense Compression Gaskets: Molded or extruded gaskets of material indicated below, complying with standards referenced with name of elastomer indicated below, and of profile and hardness required to maintain watertight seal:
 - 1. Neoprene, ASTM C864.
 - 2. EPDM, ASTM C864.
 - 3. Silicone, ASTM C1115.
 - 4. Thermoplastic polyolefin rubber, ASTM C1115.
- C. Manufacturers: Subject to compliance with requirements, provide products by one of the following companies.

1. Lock-Strip Gaskets:
 - a. Stanlock Division, Griffith Rubber Mills.
2. Preformed Gaskets:
 - a. Advanced Elastomer Systems, L.P., an EXXON Mobile Chemical Affiliate
 - b. Schnee-Morehead, Inc., an ITW Co.
 - c. Tremco, Inc., an RPM Co.

2.7 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials involved for glazing application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers and Sealers: Type recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Elastomeric material with a Shore A durometer hardness of 85 plus or minus 5.
- D. Spacers: Elastomeric blocks or continuous extrusions with a Shore A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side-walking).
- F. Compressible Filler Rod: Shall be closed-cell or waterproof jacketed rodstock of synthetic rubber or plastic foam with proven compatibility with sealants used. Rod shall be flexible and resilient with 5-10 PSI compression strength for 25 percent deflection.

2.8 FABRICATION OF GLASS

- A. Fabricate glass and other glazing products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with recommendations of product manufacturer and referenced glazing standard as required to comply with system performance requirements.
- B. Clean cut or flat grind vertical edges of butt-glazed monolithic lites in a manner that produces square edges with slight kerfs at junctions with indoor and outdoor faces.

PART 3 - EXECUTION

3.1 STANDARDS AND PERFORMANCE

- A. Watertight and airtight installation of each piece of glass required, except as otherwise shown. Each installation must withstand normal temperature changes, wind loading, impact loading (for operating sash and doors) without failure, including loss or breakage of glass, failure of sealants or gaskets to remain watertight and air tight, deterioration of glazing materials, and other defects in the Work.
- B. Protect glass from edge damage at all times during handling, installation, and operation of the building.
- C. Glazing channel dimensions as shown are intended to provide for necessary minimum bite on the glass, minimum edge clearance, and adequate sealant thicknesses with reasonable tolerances. The glazier is responsible for correct glass size for each opening within the tolerances and necessary dimensions established.
- D. Comply with combined recommendations of glass manufacturer and manufacturer of sealants and other materials used in glazing and their technical representatives except where more stringent requirements are shown or specified.
- E. Comply with "Glazing Manual" by Flat Glass Marketing Association and the manufacturers of the glass and glazing materials except as shown and specified otherwise.
- F. Inspect each piece of glass immediately before installation and eliminate those which have observable edge damage or face imperfections.

- G. Unify appearance of each series of lights by setting each piece to match others as nearly as possible. Inspect each piece and set with pattern, draw, and blow oriented in the same direction as other pieces.

3.2 EXAMINATION

- A. Examine glass framing, with glazier present, for compliance with the following:
 - 1. Manufacturing and installation tolerances, including those for size, squareness, offsets at corners.
 - 2. Presence and functioning of weep system.
 - 3. Minimum required face or edge clearances.
 - 4. Effective sealing between joints of glass-framing members.
- B. Do not proceed with glazing until unsatisfactory conditions have been corrected.

3.3 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings that are not firmly bonded to substrates.

3.4 GLAZING, GENERAL

- A. Comply with combined recommendations of manufacturers of glass, sealants, gaskets, and other glazing materials, except where more stringent requirements are indicated, including those in referenced glazing publications.
- B. Protect glass from edge damage during handling and installation as follows:
 - 1. Use a rolling block in rotating glass units to prevent damage to glass corners. Do not impact glass with metal framing. Use suction cups to shift glass units within openings; do not raise or drift glass with a pry bar. Rotate glass lites with flares or bevels on bottom horizontal edges so edges are located at top of opening, unless otherwise indicated by manufacturer's label.
 - 2. Remove damaged glass from Project site and legally dispose of offsite. Damaged glass is glass with edge damage or other imperfections that, when installed, weaken glass and impair performance and appearance.
- C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.
- D. Install elastomeric setting blocks in sill rabbets, sized and located to comply with referenced glazing standard, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- F. Provide spacers for glass sizes larger than 50 united inches (length plus height) as follows:
 - 1. Locate spacers inside, outside, and directly opposite each other. Install correct size and spacing to preserve required face clearances, except where gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and comply with system performance requirements.
 - 2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- G. Provide edge blocking to comply with requirements of referenced glazing publications, unless otherwise required by glass manufacturer.
- H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- I. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

- J. Square cut wedge-shaped gaskets at corners and install gaskets in manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.5 GASKET GLAZING (DRY)

- A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with stretch allowance during installation.
- B. Secure compression gaskets in place with joints located at corners to compress gaskets producing a weather tight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- C. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

- A. Install continuous spacers between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel weep systems until sealants cure. Secure spacers in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass. Install pressurized gaskets to protrude slightly out of channel to eliminate dirt and moisture pockets.

3.7 LOCK-STRIP GASKET GLAZING

- A. Comply with ASTM C 716 and gasket manufacturer's printed recommendations. Provide supplementary wet seal and weep system unless otherwise indicated.

3.8 PROTECTION AND CLEANING

- A. Protect exterior glass from breakage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove them immediately as 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 than once a month, for build-up of dirt, scum, alkali deposits, or stains, and remove as recommended by glass manufacturer.
- D. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in any way, including natural causes, accidents and vandalism, during construction period.
- E. Wash glass on both faces in each area of Project not more than four (4) days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended by glass manufacturer.

END OF SECTION

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SECTION 08 80 20 - SPANDREL INSULATED PANELS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES:

- A. Provide labor, material, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
 - 1. Double-Glazed Solar Control Insulating Glass Units.

1.3 REFERENCE STANDARDS

- A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Current Edition.
- B. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.
- C. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test; 2015 (Reaffirmed 2020).
- D. ASTM C1036 - Standard Specification for Flat Glass; 2021.
- E. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.
- F. GANA – Glazing Manual.
- G. Materials.
- H. SGCC – Safety Glazing Certification Council.

1.4 DEFINITIONS

- A. Sealed Insulating Glass Unit Surfaces:
 - 1. Surface No. 1: Exterior surface of outer lite.
 - 2. Surface No. 2: Interior surface of outer lite.
 - 3. Surface No. 3: Exterior surface of inner lite.
 - 4. Surface No. 4: Interior surface of inner lite.
- B. Airspace: Space between lites of an insulating glass unit that contains dehydrated air or other inert specified gas.

1.5 ACTION SUBMITTALS

- A. See Section 013000 – Administrative Requirements and Section 016000 – Product Requirements for submittal procedures.
- B. Product Data: For each product and glazing material indicated.
- C. Shop Drawings: Submit manufacturer's or fabricator's shop drawings, including plans, elevations, sections, and details, indicating glass dimensions, tolerances, types, thicknesses, and coatings.
- D. Samples: For each type of panel; 12 inches (304.8 mm) square.
- E. Fabricator's Certification: Submit fabricator's certification by manufacturer.
- F. Cleaning Instructions: Submit manufacturer's cleaning instructions.
- G. Warranty: Submit manufacturer's standard warranty for sealed insulating glass units.

1.6 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Provide products from a firm that makes the indicated products as a regular production item and with not less than ten (10) years experience.
- B. Fabricator's Qualifications: Minimum of 5 years experience manufacturing sealed insulating glass units meeting ASTM E 2190.
- C. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.
- D. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect panels according to manufacturer's written instructions. Prevent damage to panels from condensation, temperature changes, direct exposure to sun, or other causes.

1.8 WARRANTY

- A. Manufacturer's Products: Manufacturer's standard form in which panel manufacturer agrees to replace units that deteriorate or delamination within specified warranty period.
 - 1. Warranty Period: Five (5) years from date of Substantial Completion.

1.9 PERFORMANCE

- A. Safety Glass: Tested and labeled to CPSC 16 CFR 1201. Safety film not acceptable as alternative to tempered or laminated glass.
- B. Approvals: Manufacturer shall certify that product complies with and has been tested and approved in compliance with Florida Product Approval or Miami Dade NOA and applicable requirements.

PART 2 – PRODUCTS

2.1 MANUFACTURER

- A. Manufacturer shall be the following however products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product and acceptance is provided by the Architect in writing prior to bidding.
 - 1. Guardian Glass

2.2 MANUFACTURER

- A. Basis of Design:
 - 1. Sealed Insulating Glass Units, Heat-Strengthened Glass, Tempered Glass, and Spandrel Glass.

2.3 SOLAR CONTROL INSULATING COATED GLASS

- A. Double Sputter-Coated Insulating Glass Units:
 - 1. Conformance: ASTM E 2190.
 - 2. Outboard Lite: Sputter-coated **Guardian Clear Glass (North America)** glass.
 - a. **Guardian Clear Glass (North America)** Glass: ASTM C 1036, Type 1, Class 1, Quality q3.
 - b. Vacuum Deposition Sputtered Coating: ASTM C 1376.
 - c. Coating on Surface No. 2: **Guardian No. 2: SunGuard® SNX 70+ (North America)**.
 - d. Glass Thickness: **1/4" (6mm)**.
 - e. Heat Treatment: [None] [Heat-strengthened, ASTM C 1048, Kind HS] [Tempered; ASTM C 1048, Kind FT; CPSC 16CFR-1201; ANSI Z 97.1] as necessary to meet applicable codes and performance requirements.
 - 3. Air Space: **1/2" (12.7mm)** wide, hermetically sealed, dehydrated **100% Air** space.
 - 4. Inboard Lite: **Guardian Clear Glass (North America)** glass.
 - a. **Guardian Clear Glass (North America)** Glass: ASTM C 1036, Type 1, Class 1, Quality q3.

- b. Glass Thickness: **1/4" (6mm)**.
- c. Coating on Surface No. 4: Guardian **No. 4: Warm Gray Frit 100% Full Coverage**
- d. Heat-Treatment: [None] [Heat-strengthened, ASTM C 1048, Kind HS] [Tempered; ASTM C 1048, Kind FT; CPSC 16CFR-1201; ANSI Z 97.1] as necessary to meet applicable codes and performance requirements.
- 5. Glass Unit Performance Characteristics:
 - a. Visible Light Transmittance: **2**
 - b. Visible Light Reflectance Outdoors: **21**
 - c. Winter U-Value Nighttime: **0.285**
 - d. Summer U-Value Daytime: **0.265**
 - e. Solar Heat Gain Coefficient: **0.21**
- 6. Edge Seals: ASTM E 2188, with aluminum spacers, dual-sealed with a primary seal of polyisobutylene and a secondary seal of silicone sealant for glass-to-spacer seals.
- 7. Sealant: Approved by glass manufacturers.

2.4 FINISHES

- A. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- B. Color and Gloss: As selected by Architect from full range of industry colors and color densities.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive glass. Notify Architect of conditions that would adversely affect installation. Do not proceed with installation until unsatisfactory conditions are corrected.

3.2 PREPARATION

- A. Verify glazing openings are correct size and within tolerance.
- B. Verify glazing channels, recesses, and weeps are clean and free of obstructions.

3.3 GLAZING, GENERAL

- A. Install glass in accordance with manufacturer's instructions, except where local codes or GANA Glazing Manual indicate more stringent requirements.

3.4 FIELD QUALITY CONTROL

- A. Coated glass, when viewed from minimum of 10 feet, exhibiting slightly different hue or color not apparent in hand samples, will not be cause of rejection of glass units, as determined by Architect.
- B. Verify glass is free of chips, cracks, and other inclusions that could inhibit structural or aesthetic integrity.

3.5 CLEANING

- A. Clean glass promptly after installation in accordance with manufacturer's instructions.
- B. Remove labels from glass surface.
- C. Do not use harsh cleaning materials or methods that would damage glass.

3.6 PROTECTION

- A. Protect installed glass from damage during construction.
- B. Protect installed glass from contact with contaminating substances resulting from construction operations.
- C. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in other ways during construction period, including natural causes, accidents, and vandalism.

END OF SECTION

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SECTION 09 05 61 - COMMON WORK RESULTS FOR FLOORING PREPARATION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specification and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

- A. This section applies to floors identified in Contract Documents that are receiving the following types of floor coverings:
 - 1. Resilient tile .
 - 2. Carpet tile.
 - 3. Thin-set ceramic tile.
- B. Removal of existing floor coverings.
- C. Preparation of existing concrete floor slabs for installation of floor coverings.
- D. Testing of concrete floor slabs for moisture and alkalinity (pH).
- E. Remediation of concrete floor slabs due to unsatisfactory moisture or alkalinity (pH) conditions.
 - 1. Contractor shall perform all specified remediation of concrete floor slabs. If such remediation is indicated by testing agency's report and is due to a condition not under Contractor's control or could not have been predicted by examination prior to entering into the contract, a contract modification will be issued.
- F. Patching compound.
- G. Remedial floor coatings.
- H. Remedial floor treatment.

1.3 RELATED REQUIREMENTS

- A. Section 01 23 00 - Alternates: Alternate bid for replacing existing ceramic tile flooring with new ceramic tile..
- B. Section 01 40 00 - Quality Requirements: Additional requirements relating to testing agencies and testing.
- C. Section 01 74 19 - Construction Waste Management and Disposal: Handling of existing floor coverings removed.
- D. Section 093000 - Tiling: Alternate Bid to replace existing ceramic tile flooring with new ceramic tile.
- E. Section 096500 - Resilient Flooring.
- F. Section 096

1.4 PRICE AND PAYMENT PROCEDURES

- A. Alternates: See Section 01 23 00 - Alternates.

1.5 REFERENCE STANDARDS

- A. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 50 mm [2 in.] Cube Specimens); 2023.
- B. ASTM C472 - Standard Test Methods for Physical Testing of Gypsum, Gypsum Plasters, and Gypsum Concrete; 2020.
- C. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2023.
- D. RFCI (RWP) - Recommended Work Practices for Removal of Resilient Floor Coverings; 2018.

1.6 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate scheduling of cleaning and testing, so that preliminary cleaning has been completed for at least 24 hours prior to testing.

1.7 REFERENCES

- A. Refer to specification Section 014100 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.8 SUBMITTALS

- A. See Section 013000 – Administrative Requirements and Section 016000 – Product Requirements for submittal procedures.
- B. Visual Observation Report: For existing floor coverings to be removed.
- C. Floor Covering and Adhesive Manufacturers' Product Literature: For each specific combination of substrate, floor covering, and adhesive to be used; showing:
 - 1. Moisture and alkalinity (pH) limits and test methods.
 - 2. Manufacturer's required bond/compatibility test procedure.
- D. Remedial Materials Product Data: Manufacturer's published data on each product to be used for remediation.
- E. Testing Agency's Report:
 - 1. Description of areas tested; include floor plans and photographs if helpful.
 - 2. Summary of conditions encountered.
 - 3. Moisture and alkalinity (pH) test reports.
 - 4. Copies of specified test methods.
 - 5. Recommendations for remediation of unsatisfactory surfaces.
 - 6. Product data for recommended remedial coating.
 - 7. Submit report to Architect.
 - 8. Submit report not more than two business days after conclusion of testing.
- F. Adhesive Bond and Compatibility Test Report.
- G. Copy of RFCI (RWP).

1.9 QUALITY ASSURANCE

- A. Moisture and alkalinity (pH) testing shall be performed by an independent testing agency employed and paid by Contractor.
- B. Testing Agency Qualifications: Independent testing agency experienced in the types of testing specified.
 - 1. Submit evidence of experience consisting of at least 3 test reports of the type required, with project Owner's project contact information.
- C. Contractor's Responsibility Relating to Independent Agency Testing:
 - 1. Provide access for and cooperate with testing agency.
 - 2. Confirm date of start of testing at least 10 days prior to actual start.
 - 3. Allow at least 4 business days on site for testing agency activities.
 - 4. Achieve and maintain specified ambient conditions.
 - 5. Notify Architect when specified ambient conditions have been achieved and when testing will start.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, handle, and protect products in accordance with manufacturer's instructions and recommendations.
- B. Deliver materials in manufacturer's packaging; include installation instructions.
- C. Keep materials from freezing.

1.11 FIELD CONDITIONS

- A. Maintain ambient temperature in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 65 degrees F (18 degrees C) or more than 85 degrees F (30 degrees C).
- B. Maintain relative humidity in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 40 percent and not more than 60 percent.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Patching Compound: Floor covering manufacturer's recommended product, suitable for conditions, and compatible with adhesive and floor covering. In the absence of any recommendation from flooring manufacturer, provide a product with the following characteristics:
 - 1. Cementitious moisture-, mildew-, and alkali-resistant compound, compatible with floor, floor covering, and floor covering adhesive, and capable of being feathered to nothing at edges.
 - 2. Compressive Strength: 3000 psi, minimum, after 28 days, when tested in accordance with ASTM C109/C109M or ASTM C472, whichever is appropriate.
- B. Remedial Floor Coating, Single Component: Single-layer coating resistant to water vapor transmission meeting flooring manufacturer's emission limits, resistant to alkalinity (pH) level found, and suitable for flooring adhesion without further treatment.

PART 3 EXECUTION

3.1 CONCRETE SLAB PREPARATION

- A. Perform following operations in the order indicated:
 - 1. Existing concrete slabs (on-grade and elevated) with existing floor coverings:
 - a. Visual observation of existing floor covering, for adhesion, water damage, alkaline deposits, and other defects.
 - b. Removal of existing floor covering.
 - 2. Preliminary cleaning.
 - 3. Moisture vapor emission tests; 3 tests in the first 1000 square feet (100 square meters) and one test in each additional 1000 square feet (100 square meters), unless otherwise indicated or required by flooring manufacturer.
 - 4. Internal relative humidity tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
 - 5. Alkalinity (pH) tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
 - 6. Specified remediation, if required.
 - 7. Patching, smoothing, and leveling, as required.
 - 8. Other preparation specified.
 - 9. Adhesive bond and compatibility test.
 - 10. Protection.

3.2 REMOVAL OF EXISTING FLOOR COVERINGS

- A. Comply with local, State, and federal regulations and recommendations of RFCI (RWP), as applicable to floor covering being removed.
- B. Dispose of removed materials in accordance with local, State, and federal regulations and as specified.

3.3 PRELIMINARY CLEANING

- A. Clean floors of dust, solvents, paint, wax, oil, grease, asphalt, residual adhesive, adhesive removers, film-forming curing compounds, sealing compounds, alkaline salts, excessive laitance, mold, mildew, and other materials that might prevent adhesive bond.
- B. Do not use solvents or other chemicals for cleaning.

3.4 MOISTURE VAPOR EMISSION TESTING

- A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.
- C. Test in accordance with ASTM F1869 and as follows.
- D. Plastic sheet test and mat bond test may not be substituted for the specified ASTM test method, as those methods do not quantify the moisture content sufficiently.
- E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if test values exceed 3 pounds per 1000 square feet (1.4 kg per 93 square meters) per 24 hours.
- F. Report: Report the information required by the test method.

3.5 ALKALINITY TESTING

- A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- B. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if alkalinity (pH) test value is over 10.

3.6 PREPARATION

- A. See individual floor covering section(s) for additional requirements.
- B. Comply with requirements and recommendations of floor covering manufacturer.
- C. Fill and smooth surface cracks, grooves, depressions, control joints and other non-moving joints, and other irregularities with patching compound.
- D. Do not fill expansion joints, isolation joints, or other moving joints.

3.7 ADHESIVE BOND AND COMPATIBILITY TESTING

- A. Comply with requirements and recommendations of floor covering manufacturer.

3.8 APPLICATION OF REMEDIAL FLOOR COATING

- A. Comply with requirements and recommendations of coating manufacturer.

3.9 APPLICATION OF REMEDIAL FLOOR TREATMENT

- A. Comply with requirements and recommendations of treatment manufacturer.

3.10 PROTECTION

- A. Cover prepared floors with building paper or other durable covering.

END OF SECTION

SECTION 09 21 16 - GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specification and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

- A. Performance criteria for gypsum board assemblies.
- B. Metal stud wall framing.
- C. Metal channel ceiling framing.
- D. Acoustic insulation.
- E. Gypsum wallboard.
- F. Joint treatment and accessories.

1.3 REFERENCE STANDARDS

- A. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2017 (Reapproved 2022).
- B. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2023.
- C. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2020.
- D. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2024.
- E. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2022.
- F. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2017.
- G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
- H. GA-216 - Application and Finishing of Gypsum Panel Products; 2024.

1.4 REFERENCES

- A. Refer to specification Section 01 41 00 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate the installation of gypsum board assemblies with size, location, and installation of service utilities.
- B. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

1.6 ACTION SUBMITTALS

- A. See Section 01 30 00 – Administrative Requirements and Section 01 60 00 – Product Requirements for submittal procedures.
- B. Product Data:
 - 1. Provide data on metal framing, gypsum board, accessories, and joint finishing system.
- C. Shop Drawings: Indicate special details associated with fireproofing.

- D. Samples: Submit two samples of gypsum board finished with proposed texture application, 12 by 12 inches (300 by 300 mm) in size, indicating finish color and texture.
- E. Steel Framing Industry Association (SFIA) Certification:
 - 1. Submit documentation that metal studs and connectors used on project meet or exceed requirements of International Building Code.
- F. Installer's Qualification Statement.

1.7 QUALITY ASSURANCE

- A. SFIA Code Compliance Certification Program: www.CFSteel.org/#sle: Use metal studs and connectors certified for compliance with International Building Code.
- B. Manufacturer Qualifications: Member of Steel Stud Manufacturers Association (SSMA): www.ssma.com/#sle.
- C. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.
- D. Documents at Project Site: Maintain at the project site a copy of manufacturer's instructions.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store gypsum products and accessories indoors and keep above freezing. Elevate boards above floor, on nonwicking supports, in accordance with manufacturer's recommendations.
- B. Store metal products to prevent corrosion.

PART 2 PRODUCTS

2.1 GYPSUM BOARD ASSEMBLIES

- A. Provide completed assemblies complying with ASTM C840 and GA-216.
- B. See Wall Types as indicated on Drawings.
- C. Interior Partitions: Provide completed assemblies with the following characteristics:
 - 1. Acoustic Attenuation: STC of 45-49 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.

2.2 METAL FRAMING MATERIALS

- A. Steel Sheet: ASTM A1003/A1003M, subject to the ductility limitations indicated in AISI S220 or equivalent.
 - 1. Structural Grade: As required to meet design criteria.
 - 2. Corrosion Protection Coating Designation: G40, or equivalent in accordance with AISI S220.
- B. Manufacturers - Metal Framing, Connectors, and Accessories:
 - 1. CEMCO: www.cemcosteel.com/#sle.
 - 2. ClarkDietrich: www.clarkdietrich.com/#sle.
 - 3. Jaimes Industries: www.jaimesind.com/#sle.
 - 4. MarinoWARE: www.marinoware.com/#sle.
 - 5. Phillips Manufacturing Co: www.phillipsmfg.com/#sle.
 - 6. R-stud: www.rstud.com/#sle.
 - 7. SCAFCO Corporation: www.scafco.com/#sle.
 - 8. Steel Construction Systems: www.steelconsystems.com/#sle.
 - 9. Telling Industries: www.tellingindustries.com/#sle.
 - 10. Substitutions: See Section 016000 - Product Requirements for substitution procedures.
- C. Nonstructural Framing System Components: AISI S220; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/120 at 5 psf (L/120 at 240 Pa).
 - 1. Studs: C-shaped with knurled or embossed faces.
 - a. Products:

- 1) MBA Building Supplies; ProSTUD: www.mbastuds.com/#sle.
 - 2) R-stud; R-stud: www.rstud.com/#sle.
 - 3) Super Stud Building Products, Inc; The EDGE: www.buysuperstud.com/#sle.
 - 4) Substitutions: See Section 016000 - Product Requirements for substitution procedures.
2. Runners: U shaped, sized to match studs.
 3. Ceiling Channels: C-shaped.
 4. Resilient Furring Channels: Single or double leg configuration; 1/2 inch (13 mm) channel depth.
 - a. Products:
 - 1) Same manufacturer as other framing materials.
- D. Partition Head To Structure Connections: Provide track fastened to structure with legs of sufficient length to accommodate deflection, for friction fit of studs cut short and screwed to secondary deflection channel set inside but unattached to top track.
- E. Non-structural Framing Accessories:
1. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.
 2. Partial Height Wall Framing Support: Provides stud reinforcement and anchored connection to floor.
 - a. Materials: ASTM A36/A36M formed sheet steel support member with factory-welded ASTM A1003/A1003M steel plate base.
- F. Grid Suspension Systems: Steel grid system of main tees and support bars connected to structure using hanging wire.
1. Products:
 - a. CertainTeed Corporation: www.certainteed.com/ceilings-and-walls/#sle.
 - b. USG Corporation; Drywall Suspension System: www.usg.com/#sle.
 - c. Substitutions: See Section 01 60 00 - Product Requirements.

2.3 BOARD MATERIALS

- A. Manufacturers - Gypsum-Based Board:
1. American Gypsum Company: www.americangypsum.com/#sle.
 2. CertainTeed Corporation: www.certainteed.com/#sle.
 3. Georgia-Pacific Gypsum: www.gpgypsum.com/#sle.
 4. Gold Bond Building Products, LLC provided by National Gypsum Company: www.goldbondbuilding.com/#sle.
 5. PABCO Gypsum: www.pabcogypsum.com/#sle.
 6. USG Corporation: www.usg.com/#sle.
 7. Substitutions: See Section 016000 - Product Requirements for substitution procedures.
- B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
1. Application: Use for vertical surfaces, unless otherwise indicated.
 2. At Assemblies Indicated with Fire-Resistance Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
 3. Thickness:
 - a. Vertical Surfaces: 5/8 inch (16 mm).
 - b. Ceilings: 1/2 inch (13 mm).
 4. Paper-Faced Products:
 - a. American Gypsum Company; FireBloc Type X Gypsum Wallboard: www.americangypsum.com/#sle.
 - b. CertainTeed Corporation; Type X Drywall: www.certainteed.com/#sle.
 - c. Georgia-Pacific Gypsum; ToughRock Fireguard X: www.gpgypsum.com/#sle.

- d. Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond Fire-Shield C 5/8" Gypsum Board: www.goldbondbuilding.com/#sle.
 - e. USG Corporation; Sheetrock Brand Firecode X Panels 5/8 in. (15.9 mm): www.usg.com/#sle.
 - f. USG Corporation; Sheetrock Brand UltraLight Panels Firecode ULIX 5/8 in. (15.9 mm): www.usg.com/#sle.
 - g. Substitutions: See Section 016000 - Product Requirements for substitution procedures.
- C. Backing Board For Wet Areas: One of the following products:
- 1. Application: Surfaces behind tile in wet areas.
 - 2. ANSI Cement-Based Board: Non-gypsum-based; aggregated Portland cement panels with glass fiber mesh embedded in front and back surfaces complying with ANSI A118.9 or ASTM C1325.
 - a. Thickness: 5/8 inch (16 mm).
 - b. Products:
 - 1) USG Corporation; Fiberock Brand Tile Backerboard FRX-G 5/8 in. (15.9 mm): www.usg.com/#sle.
 - 2) Substitutions: See Section 01 60 00 - Product Requirements.

2.4 GYPSUM BOARD ACCESSORIES

- A. Acoustic Insulation: ASTM C665; preformed mineral-fiber, friction fit type, unfaced; thickness as indicated on Drawings.
- B. Beads, Joint Accessories, and Other Trim: ASTM C1047, galvanized steel, unless noted otherwise.
- 1. Corner Beads: Low profile, for 90 degree outside corners.
 - a. Products:
 - 1) CertainTeed Corporation; No-Coat Drywall Corner: www.certainteed.com/#sle.
 - 2) ClarkDietrich; Strait-Flex OS-300: www.clarkdietrich.com/#sle.
 - 3) Flannery, Inc; Corner Beads: www.flannerytrim.com/#sle.
 - 4) Phillips Manufacturing Co; Everlast Corner Bead: www.phillipsmfg.com/#sle.
 - 5) Substitutions: See Section 01 25 00 - Substitution Procedures.
 - 2. L-Trim: Sized to fit 5/8-inch (____ mm) thick gypsum wallboard.
 - a. Products:
 - 1) Phillips Manufacturing Co: www.phillipsmfg.com/#sle.
 - 2) Substitutions: See Section 016000 - Product Requirements for substitution procedures.
- C. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
- 1. Paper Tape: 2 inch (50 mm) wide, creased paper tape for joints and corners, except as otherwise indicated.
 - 2. Joint Compound: Setting type, field-mixed.
- D. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inches (0.84 mm) in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion-resistant.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that project conditions are appropriate for work of this section to commence.

3.2 FRAMING INSTALLATION

- A. Metal Framing: Install in accordance with ASTM C1007/AISI S220 and manufacturer's instructions.
- B. Suspended Ceilings and Soffits: Space framing and furring members as indicated.

- C. Studs: Space studs at 16 inches on center (at 406 mm on center).
 - 1. Extend partition framing to structure where indicated and to ceiling in other locations.
 - 2. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.
 - 3. Partitions Terminating at Structure: Attach extended leg top runner to structure, maintain clearance between top of studs and structure, and brace both flanges of studs with continuous bridging.
- D. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.
- E. Blocking: Install wood blocking for support of:
 - 1. Framed openings.
 - 2. Wall-mounted cabinets.
 - 3. Toilet partitions.
 - 4. Toilet accessories.
 - 5. Wall-mounted door hardware.

3.3 ACOUSTIC ACCESSORIES INSTALLATION

- A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.
- B. Acoustic Sealant: Install in accordance with manufacturer's instructions.
 - 1. Place one bead continuously on substrate before installation of perimeter framing members.

3.4 BOARD INSTALLATION

- A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.
- B. Single-Layer Nonrated: Install gypsum board as indicated on Wall Type description, with ends and edges occurring over firm bearing.
 - 1. Exception: Tapered edges to receive joint treatment at right angles to framing.
- C. Cementitious Backing Board: Install over steel framing members and plywood substrate where indicated, in accordance with ANSI A108.11 and manufacturer's instructions.

3.5 INSTALLATION OF TRIM AND ACCESSORIES

- A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
- B. Corner Beads: Install at external corners, using longest practical lengths.
- C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

3.6 JOINT TREATMENT

- A. Paper Faced Gypsum Board: Use paper joint tape, embed with drying type joint compound and finish with drying type joint compound.
- B. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
 - 1. Level 5: Walls and ceilings to receive semi-gloss or gloss paint finish and other areas specifically indicated.
 - 2. Level 3: Walls to receive textured wall finish.
 - 3. Level 1: Fire-resistance-rated wall areas above finished ceilings, whether or not accessible in the completed construction.
- C. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
 - 1. Feather coats of joint compound so that camber is maximum 1/32 inch (0.8 mm).
- D. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.

3.7 TOLERANCES

- A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet (3 mm in 3 m) in any direction.

3.8 CLEANING

- A. See Section 01 77 00 - Closeout Procedures for additional requirements.

3.9 PROTECTION

- A. Protect installed gypsum board assemblies from subsequent construction operations.

END OF SECTION

SECTION 09 24 23 - PORTLAND CEMENT STUCCO

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES:

- A. Provide labor, material, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
 - 1. Exterior Portland cement stucco.
 - 2. Air and water resistive barrier.
- B. Basis of Design Systems:
 - 1. "Sto Powerwall® ExtraSeal" for Direct Applied Stucco at concrete and concrete masonry construction. Manufacturer: Sto Corp.

1.3 REFERENCE STANDARDS

- A. ASTM C150 – Standard Specification for Portland Cement.
- B. ASTM C206 – Standard Specification for Finishing Hydrated Lime.
- C. ASTM C207 – Standard Specification for Hydrated Lime for Masonry Purposes.
- D. ASTM C578 – Standard Specification for Preformed, Cellular Polystyrene Thermal Insulation.
- E. ASTM C897 – Standard Specification for Aggregate for Job Mixed Portland Cement-Based Plasters.
- F. ASTM C920 – Standard Specification for Elastomeric Joint Sealants.
- G. ASTM C926 – Standard Specification for Application of Portland Cement Based Plaster.
- H. ASTM C1002 Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
- I. ASTM C1513 – Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections.
- J. ASTM D1784 - Standard Specification for Rigid Poly Vinyl Chloride Compounds and Chlorinated Poly Vinyl Chloride Compounds.
- K. ASTM D4541 – Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.
- L. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
- M. ASTM E96 – Standard Test Methods for Water Vapor Transmission of Materials.
- N. ASTM E119 – Standard Test Methods for Fire Tests of Building Construction and Materials.
- O. ASTM E2178 - Standard Test Method for Air Permeance of Building Materials.
- P. ASTM E2357 – Standard Test Method for Determining Air Leakage of Air Barrier Assemblies.
- Q. PCA (Portland Cement Association) – Plaster (Stucco) Manual.

1.4 REFERENCES

- A. Refer to specification Section 01 41 00 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 ACTION SUBMITTALS

- A. See Section 01 30 00 – Administrative Requirements and Section 01 60 00 – Product Requirements for submittal procedures.

- B. Product Data: For each type of product indicated submit manufacturer's product specifications, details, installation instructions and other data as may be required to show compliance with these specifications.
- C. Shop Drawings: Show locations and installation of control and expansion joints. Include plans, elevations, sections, details of components, and attachments to other work.
- D. Samples: For each type of finish indicated; 12 by 12 inches (305 by 305 mm), prepared on rigid backing.
- E. Code Compliance Reports for air and water resistive barrier and EPS foam trim board. By an approved agency.
- F. Manufacturer's NFPA 285 assembly report or ICC ESR indicating compliance of air and water barrier and drainage mat with requirements of NFPA 285 for use in noncombustible construction.
- G. Fastener manufacturer's pull-out or withdrawal capacity testing for frame and solid substrates.
- H. Manufacturer's standard warranty.

1.6 QUALITY ASSURANCE

- A. Manufacturer Requirements: Cement plaster and air barrier product manufacturer for a minimum of (20) years.
- B. Applicator/Installer Requirements: Company specializing in lath and plaster work for a minimum of five (5) years, trained and approved by manufacturer for application of products specified in this Section.

1.7 MOCK-UP

- A. Mock-ups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
- B. Build mock-ups for each substrate and finish texture indicated for cement plastering, including accessories.
- C. Size: 100 sq. ft. in surface area.
- D. Approval of mock-ups does not constitute approval of deviations from the Contract Documents contained in mock-ups unless Architect specifically approves such deviations in writing.

1.8 PRE-INSTALLATION MEETINGS

- A. The Contractor shall conduct a pre-installation meeting at the project site a minimum of 30 days prior to any work being installed as indicated in this section and other related sections that require coordination with this section.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver all materials in manufacturer's original sealed containers bearing manufacturer's name and identification of product.
- B. Store materials in accordance with manufacturer's instructions.
- C. 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.

1.10 FIELD CONDITIONS

- A. Exterior Plasterwork:
 - 1. Apply and cure plaster to prevent plaster drying out during curing period. Use procedures required by climatic conditions, including moist curing, providing coverings, and providing barriers to deflect sunlight and wind.
 - 2. Apply plaster when ambient and surface temperatures are greater than 40 deg F (4.4 deg C) during application and for 24 hours after set of stucco, and after application of air and water resistive barrier and finish materials.

3. Prevent uneven or excessive evaporation of moisture from stucco during hot, dry, or windy weather. For installation under any of these conditions, provide special measures to properly moist cure the stucco in accordance with manufacturer's recommendations. Do not install stucco if ambient temperatures are expected to rise above 100°F within a 24-hour period.
4. Provide protection of surrounding areas and adjacent surfaces from application of materials.

1.11 PERFORMANCE REQUIREMENTS

- A. Air and Water Resistive Barrier at concrete masonry:
 1. Water Penetration: ASTM E514, no water penetration through concrete masonry after 4-hour spray period.
 2. Adhesion: ASTM D4541, greater than or equal to 50 psi on prepared CMU substrates.
 3. Water Vapor Permeance: ASTM E96 Method B: minimum 5 perms.
 4. Air Permeance: ASTM E2178, less than or equal to 0.004 cfm/ft² air leakage at 1.57 psf.
- B. Stucco Base:
 1. Stucco scratch and brown coat material in compliance with ASTM C926.
 2. ICC-ESR 2323 Sto Powerwall Stucco Systems.
- C. Primer:
 1. Alkaline resistant primer for freshly placed (minimum 4 days old) stucco surfaces.
 2. Resistant to alkaline surfaces with pH of 13 or less.
 3. Surface Burning, ASTM E84: Flame Spread less than 25, Smoke Developed less than 450; Class A building material.
 4. VOC: less than 50 g/L.
- D. Flexible Acrylic Finish:
 1. Accelerated Weathering, ASTM G154: 2000 hours, no blistering, checking cracking, crazing, or other deleterious effects.
 2. Water Vapor Permeability, ASTM E96, Method B: > 15 perms.
 3. Surface Burning, ASTM E84: Flame Spread less than 25, Smoke Developed less than 450; Class A building material.
 4. VOC: less than 50 g/L.

1.12 COORDINATION

- A. Provide minimum 28-day cure of concrete and concrete masonry units before the installation of air barrier and stucco components.
- B. Install primary air barrier and connecting air barrier components before installing stucco accessories.
- C. Provide protection of rough openings before installing windows, doors, and other penetrations.
- D. Provide sill flashing before windows and doors are installed to direct water beyond the finished exterior wall surface.
- E. Install diverter flashings wherever water can enter the wall assembly to direct water to the exterior.
- F. Coordinate installation of foundation dampproofing/waterproofing, roofing membrane, windows, doors and other wall penetrations to provide a continuous air barrier and continuous moisture protection. Provide protection of rough openings before installing windows, doors, and other penetrations through the wall and provide sill flashing. Coordinate installation of air and water-resistive barrier components with window and door installation to provide weather proofing of the structure and to prevent moisture infiltration and excess air infiltration.
- G. Install window and door head flashing immediately after windows and doors are installed.
- H. Protect air and water-resistive barrier with drainage mat within 30 days of installation.

- I. Commence the stucco installation after completion of all floor, roof construction and other construction that imposes dead loads on the walls to prevent excessive deflection (and potential cracking) of the stucco.
- J. Provide site grading such that the stucco terminates above earth grade minimum 4 inches (100 mm) and above finished grade (pavers/sidewalk) minimum 2 inches (51 mm).
- K. Install copings, cap flashings, sills, and sealant to prevent water entry into the wall assembly immediately after installation of the stucco and after finish coatings are dry.
- L. Attach penetrations through stucco to structural support and provide air tight and water tight seals at penetrations.

1.13 WARRANTY

- A. Provide manufacturer's standard warranty.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design Air and Water-Resistive Barrier, Portland Cement Stucco, Stucco Primers, Stucco Finishes, Joint Sealants: "StoPowerwall® ExtraSeal" and "Sto Powerwall® DrainScreen®" Systems.Sto Corp.
- B. Sto Corp.
- C. Substitutions: See Section 016000 - Product Requirements for substitution procedures.

2.2 BASIS OF DESIGN SYSTEMS:

- A. "Sto Powerwall® ExtraSeal" for Direct Applied Stucco at concrete and concrete masonry construction. Manufacturer: Sto Corp."
- B. Sto Powerwall® DrainScreen®" at metal stud framed construction. Manufacturer: Sto Corp.

2.3 AIR & WATER-RESISTIVE BARRIER

- A. Air and Water Resistive Barrier for Concrete and Concrete Masonry:
- B. "Sto Gold Coat": Ready mixed vapor permeable air and water-resistive barrier coating applied to Glass Mat Gypsum Sheathing:
 - 1. High-Build installation in two or three coats to achieve 40 mils WFT. If applied by roller apply three or more coats as needed.
- C. Detail Components for sealing transitions, dissimilar materials, small penetrations or attachments and other static transitions, rough opening protection and other detailing in above grade wall construction.
 - 1. Sto RapidGuard®: One component STPE rapid drying gun-applied liquid flashing for sheathing joints, rough openings, seams, cracks, penetrations and other static transitions in above grade wall construction
 - 2. StoGuard Fabric: Nonwoven cloth reinforcement used with Sto Gold Coat for rough opening protection, joint treatment of wall sheathing, and detail component for shiplap connections with flashing, weep screed, and similar shingle lap details.
 - 3. StoGuard RediCorner: A preformed fabric piece used in the corners of rough openings in tandem with StoGuard Fabric.
 - 4. StoGuard Conformable Membrane: Self-adhered membrane flashing for use over prepared vertical above-grade concrete, concrete masonry, masonry control joints, expansion joints in masonry or frame construction, glass mat gypsum sheathing and other dynamic joint conditions in above grade wall construction.

2.4 LATH

- A. Minimum 2.5 lb./yd² (1.4 kg/m²) self-furred galvanized steel paper backed diamond mesh metal lath in compliance with ASTM C847. For applications over metal framed exterior walls and soffits. Fasten lath through glass mat gypsum sheathing to metal framing.

2.5 MECHANICAL FASTENERS

- A. Non-corroding fasteners in compliance with ASTM C1513:
 - 1. Concrete or Masonry – minimum # 8 wafer head fully threaded stainless steel screws for masonry with minimum 1 inch (25 mm) penetration into substrate.
- B. Tie Wire – 18 gauge galvanized and annealed low-carbon steel in compliance with ASTM A641 with Class I coating.

2.6 ACCESSORIES

- A. Weep screed shall be extruded aluminum.
- B. Casing bead, corner bead, corner lath, expansion and control joint accessories and all other accessories shall be zinc or zinc coated. All accessories shall meet the requirements of ASTM C1063 and its referenced documents.
- C. All accessories shall have perforated or expanded flanges and shall be designed with grounds for the specified thickness of stucco.
- D. “StoSeal” STPE joint sealant in conformance with ASTM D920: Type S, Grade NS, Use NT, A, M, Class 100/50.
- E. Patching and Leveling Material for Prepared Concrete and Concrete Masonry:
 - 1. Sto Leveler and Skim Coat: Polymer modified cement based patch and leveling material for applications up to 1/4-inch in depth.

2.7 JOB MIXED INGREDIENTS

- A. Water: clean and potable.
- B. Sand: in compliance with ASTM C897 or ASTM C144, for use with ASTM C926 stucco concentrates.

2.8 STUCCO

- A. “108 Powerwall Scratch and Brown”: Portland cement-based stucco concentrate in compliance with ASTM C926.
- B. ASTM C926 compliant stucco brown coats as listed by Sto Corp. in the “Addendum to Sto Powerwall Specifications”.

2.9 CRACK DEFENSE

- A. Base Coat
 - 1. “Sto BTS Xtra”: Lightweight one component polymer modified cement-based extra high build base coat material.
- B. Reinforcing Mesh
 - 1. Sto Mesh – nominal 4.5 oz./yd² (153 g/m²), symmetrical, interlaced open-weave glass fiber mesh made with alkaline resistant coating for compatibility with Sto materials.

2.10 PRIMER

- A. StoPrime Hot”: Acrylic based primer/sealer for freshly placed (minimum 4 day old) and high pH stucco surfaces.

2.11 FINISH

- A. “StoPowerwall® Fine Finish”: Integrally colored, factory blended, flexible acrylic textured wall finish with graded marble aggregate.
 - 1. Integral Color: As selected by Architect from manufacturer’s full range.

2.12 MIXING

- A. General: Comply with manufacturer’s mixing instructions for each product.
- B. StoGuard:

1. Sto Gold Coat – mix with a clean, rust-free electric drill and paddle to a uniform consistency. Do not thin or dilute with water.
- C. StoPowerwall Stucco:
 1. Refer to mix instructions on packaging. **USE ONLY THE AMOUNT OF WATER NECESSARY FOR A WORKABLE MIX.** Use of excess water is detrimental to performance.
- D. Adhesive and Base Coats for Sto Crack Defense and EPS Foam Build-outs:
 1. Refer to applicable Sto Product Bulletin for selected adhesive/base coat material(s).
- E. Primer: Mix with a clean, rust-free high speed mixer to a uniform consistency.
- F. Finish: Mix with a clean, rust-free high speed mixer to a uniform consistency. A small amount of water (up to 12 ounces [0.4 L]) may be added to adjust workability. Limit addition of water to amount needed to achieve the finish texture.
- G. Mix only as much material as can readily be used.
- H. Do not add lime, anti-freeze compounds, or other additives to any of the materials.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine areas, surfaces and substrates, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Before plaster is applied, the surfaces to be plastered shall be carefully examined by the subcontractor. The Architect and General Contractor shall be notified of unsatisfactory surfaces or conditions. Application of stucco shall not proceed until unsatisfactory conditions have been corrected.
 1. Concrete and Concrete Masonry: Verify joints are cut flush and surface is ready to receive Work. Verify no bituminous, water repellent coatings, or form release agents are on concrete surfaces to receive stucco finish.
 2. Concealed Supports, Blocking: Verify items have been installed in proper locations.
 3. Mechanical and Electrical: Verify services within walls and soffits have been

3.2 SURFACE PREPARATION

- A. Protect adjacent work from soiling, spattering, moisture deterioration, and other harmful effects caused by plastering.
- B. Prepare solid substrates for plaster that are smooth or that do not have the suction capability required to bond with plaster according to ASTM C 926.
- C. Concrete Masonry Units
 1. Remove projecting joint mortar so it is even with the plane of the wall. Remove surface contaminants such as efflorescence, existing paint or coatings, or any other surface contamination by chemical or mechanical means. Pre-moisten the surface with water just prior to placement of air barrier. Verify adhesion with load tests after stucco/air barrier assembly has fully cured (28 days) on mock-up wall, and throughout the project as recommended by manufacturer.
- D. For Concrete Masonry Units: Verify adequacy of lath attachment with respect to design wind pressures. Do not install stucco over unprepared substrates or any substrate where adhesion is in question.

3.3 AIR AND WATER BARRIER INSTALLATION

- A. The following are applicable to:
 1. Concrete and Concrete Masonry surfaces
- B. Transition Detailing

1. Detail transition areas with Sto RapidGuard (static joints and seams) or StoGuard Conformable Membrane (dynamic joints and seams) to achieve air barrier continuity. For illustrations of installation, refer to Sto Guide Details, RapidGuard Installation Guide and StoGuard Conformable Membrane Installation Guide.
- C. Rough Opening Protection
1. Sto Gold Coat with StoGuard Fabric: apply coating liberally by spray or roller to corners of openings, immediately place StoGuard RediCorners in the wet coating, and apply additional coating over the RediCorners to completely embed them. After all corners have been completed apply coating liberally to the entire rough opening, immediately place StoGuard Fabric in the wet coating, smooth any wrinkles with a brush or roller, and apply additional coating over the fabric to completely embed it. Overlap all seams minimum 2 inches (51 mm). Once completed top coat with additional coating as needed to completely seal the surface. Allow to dry and inspect for pinholes or voids. If pinholes or voids are present, seal with additional coating or Sto RapidGuard.
- D. Air and Water-Resistive Barrier Coating: Install coating to the required wet film thickness as specified by substrate and high-build installation.
- E. Air and Water-Resistive Barrier Connections and Shingle Laps:
1. Coordinate installation of connecting air barrier components with other trades to provide a continuous airtight membrane.
 2. Coordinate installation of flashing and other moisture protection components with other trades to achieve complete moisture protection such that water is directed to the exterior, not into the wall assembly, and drained to the exterior at sources of leaks (windows, doors and similar penetrations through the wall assembly).
 3. Splice-in head flashings above windows, doors, floor lines, roof/sidewall step flashing, and similar locations with StoGuard detail component to achieve shingle lap of the air and water-resistive barrier such that water is directed to the exterior.
 4. Do not allow the air and water barrier to remain exposed for more than 180 days (Sto Gold Coat).

3.4 STUCCO INSTALLATION

- A. General: Apply the stucco in discrete panels without interruption to avoid cold joints and differences in appearance. Abut wet stucco to set stucco at natural or architectural breaks in the wall such as expansion joints, pilasters, terminations, or changes in plane. Hot or dry conditions accelerate drying and moisture loss from stucco which can diminish strength and resistance to cracking. Under these conditions, adjustments in the application, scheduling and curing of stucco to prevent rapid loss of moisture are necessary to achieve a satisfactory stucco installation. Cold temperatures retard drying and strength gain and adjustments may have to be made in the application, scheduling and curing of stucco to prevent damage from frost and other trades. Do not install stucco during extremely hot, dry and/or windy conditions. Do not install stucco during freezing conditions or on frozen substrates. Do not install stucco onto grounds of accessories. Completely embed lath and flanges of accessories and completely cover fastener attachments with stucco. Moist cure stucco minimum 48 hours for optimum strength gain and resistance to cracking. Allow final stucco application to completely dry (28 days) before applying primer or finish (except in the case of StoPrime Hot which can be applied 48 hours after completing moist cure of stucco). The finished installation must be true, plumb and square. Should stucco get into control or expansion joints, remove the stucco from within the joint before the stucco sets.
- B. Direct Applied Installation at Concrete and Concrete Masonry:
1. Coordinate work with other trades to ensure air barrier continuity with connections at foundation, floor lines, flashings, lintels and shelf angles, openings and penetrations such as pipes, vents, windows and doors, masonry anchors, rafters or beams, joints in construction, projections such as decks and balconies, and roof line.
 2. Install materials only when surface and ambient temperature are minimum 40 degrees F (4 degrees C) and rising during application and drying period and below 100 degrees F (38

- degrees C). Install air barrier material to dry or damp surfaces (no standing or glistening water).
3. Mix, apply, store, and handle materials in accordance with manufacturer's written instructions.
 4. Rough Opening Protection:
 - a. Install Sto RapidGuard over wood buck and lap onto Sto ExtraSeal minimum 2 inches (51 mm). Do not install Sto ExtraSeal over Sto RapidGuard. Limit extension of Sto RapidGuard to coincide with ends of expanded flange accessories. Refer to Sto Guide Detail 65c.25.
 5. Skim Coat:
 - a. Concrete Masonry – install one liberal coat of Sto ExtraSeal in a uniform, continuous application by trowel at nominal 1/8 inch (3mm) thick. Surface must be free of voids and pinholes when dry. Final application must not show CMU surface texture or joints. Do not install over working or moving joints or joint sealants.
 6. Transitions:
 - a. Install appropriate air barrier accessory material or auxiliary material at transition areas: foundation, floor lines, flashings, lintels and shelf angles, openings and penetrations such as pipes, vents, windows and doors, masonry anchors, rafters or beams, joints in construction, projections such as decks and balconies, and roof line. Refer to Sto Guide Details 65c.xx. Limit extension of transition materials to limit of expanded flange accessories at stucco terminations.
 7. Stucco Accessories:
 - a. Install stucco accessories – casing beads, expansion and control joints – over air barrier with appropriate fasteners into supporting construction as required by ASTM C926.
 8. Scratch Coat:
 - a. Scratch coat: allow skim coat to dry minimum 24 hours and apply nominal 1/4-inch (6mm) scratch coat of Sto ExtraSeal by trowel. Scratch the surface horizontally with a stucco rake tool.
 9. Brown Coat:
 - a. Brown coat: allow scratch coat to dry minimum 24 hours and install stucco brown coat in accordance with applicable codes and manufacturer's requirements. Limit total thickness, including Sto ExtraSeal skim coat and scratch coat, and stucco brown coat, to 5/8 inches (16mm) maximum. Moist cure the brown coat in accordance with ASTM C926.
- C. Crack Defense:
1. Apply base coat over the moist cured stucco and foam build-outs with appropriate spray equipment or a stainless steel trowel to a uniform thickness of approximately 1/8-inch (3 mm). Work horizontally or vertically in strips of 40 inches (1016mm), and immediately embed the mesh into the wet base coat by troweling from the center to the edge of the mesh. Overlap mesh not less than 2-1/2 inches (64 mm) at mesh seams and at overlaps of detail mesh. Feather seams and edges. Avoid wrinkles in the mesh. The mesh must be fully embedded so that no mesh color shows through the base coat when it is dry. Re-skim with additional base coat if mesh color is visible. Do not install base coat or mesh over joints or accessories in the stucco wall assembly.
- D. Primer Installation:
1. StoPrime Hot: Moist cure stucco for a minimum of 48 hours. Allow stucco to dry an additional 48 hours, then apply primer evenly with brush, roller or proper spray equipment over the clean, dry stucco and foam build-outs, and allow to dry. Final age of primed stucco application must be minimum 7 days before application of finish.
 - a. Textured Finish Installation:
- E. Textured Finish Installation:

1. Apply finish to minimum 28-day old stucco or primed stucco and foam build-outs, or apply when pH of stucco surface is less than 10. If StoPrime Hot is used as the primer the primed stucco/foam build-out surfaces need only be minimum 7 days old. Apply finish by spraying or troweling with a stainless-steel trowel, depending on the finish specified. Follow these general rules for application of finish:
 - a. Avoid application in direct sunlight.
 - b. Apply finish in a continuous application and work a wet edge towards the unfinished wall area. Work to an architectural break in the wall before stopping to avoid cold joints.
 - c. Weather conditions affect application and drying time. Hot or dry conditions limit working time and accelerate drying. Adjustments in the scheduling of work may be required to achieve desired results; cool or damp conditions extend working time and retard drying and may require added measures of protection against wind, dust, dirt, rain and freezing. Adjust work schedule and provide protection.
 - d. Do not install separate batches of finish side-by-side.
 - e. Do not apply finish into or over sealant joints. Apply finish to outside face of wall only.
 - f. Do not apply finish over irregular or unprepared surfaces or surfaces not in compliance with the requirements of the project specifications.
 - g. Do not install finish over high pH (> 10) stucco surfaces or surfaces that have not been fully cured.
2. Sto Powerwall® Fine Finish Installation:
 - a. Refer to applicable Sto Installation Guide and Product Bulletin for selected finish.
 - b. Finish to match existing finish on adjacent Softball Concession Building, as approved by the Architect.

3.5 PROTECTION

- A. Provide protection of installed materials from water infiltration into or behind them.
- B. Provide protection of installed stucco from dust, dirt, precipitation, and freezing.
- C. Provide protection of installed primer and finish from dust, dirt, precipitation, freezing and continuous high humidity until fully dry.
- D. Provide sealant and backer material at stucco terminations and at fixture penetrations through the stucco to protect against air, water and insect infiltration. Provide weeps at floor lines, window and door heads, and other areas to conduct water to the exterior.

3.6 CLEANING, REPAIR AND MAINTENANCE

- A. Clean and maintain the stucco finish for a fresh appearance and to prevent water entry into and behind the stucco. Repair cracks, impact damage, spalls or delamination promptly.
- B. Maintain adjacent components of construction such as sealants, windows, doors, and flashing, to prevent water entry into the wall assembly.
- C. Refer to Sto reStore Repair and Maintenance Guide (reStore Program) for detailed information on stucco restoration – cleaning, repairs, recoating, resurfacing and refinishing, or re-cladding.

END OF SECTION

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SECTION 09 30 00 - TILING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

- A. Tile for floor applications.
- B. Tile for wall applications.
- C. Ceramic trim.
- D. Non-ceramic trim.

1.3 REFERENCE STANDARDS

- A. ANSI A108/A118/A136 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium); 2024.
- B. ANSI A108.1a - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar; 2023.
- C. ANSI A108.4 - American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesive or Water Cleanable Tile-Setting Epoxy Adhesive; 2023.
- D. ANSI A108.6 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grout Epoxy; 2023.
- E. ANSI A108.9 - American National Standard Specifications for Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout; 2023.
- F. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework; 2017 (Reaffirmed 2022).
- G. ANSI A118.6 - American National Standard Specifications for Standard Cement Grouts for Tile Installation; 2019.
- H. ANSI A137.1 - American National Standard Specifications for Ceramic Tile; 2022.
- I. ASTM C373 - Standard Test Methods for Determination of Water Absorption and Associated Properties by Vacuum Method for Pressed Ceramic Tiles and Glass Tiles and Boil Method for Extruded Ceramic Tiles and Non-tile Fired Ceramic Whiteware Products; 2018 (Reapproved 2023).
- J. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.
- K. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation; 2025.
- L. ANSI A118.4 - Latex-Portland Cement Mortar.
- M. ANSI A118.8 - Modified Epoxy Emulsion Mortar/Grout.
- N. ANSI A118.12 - Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone.
- O. ANSI A136.1 - Organic Adhesive for Installation of Ceramic Tile.
- P. ANSI A137.1 - Ceramic Tile.
- Q. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar.
- R. ASTM C206 - Standard Specification for Finishing Hydrated Lime.
- S. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes.

1.4 REFERENCES

- A. Refer to specification Section 014100 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by affected installers.

1.6 ACTION SUBMITTALS

- A. See Section 013000 – Administrative Requirements and Section 016000 – Product Requirements for submittal procedures.
- B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.
- C. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, thresholds, ceramic accessories, and setting details.
- D. Selection Samples: Colors to be provided for selection to be by Architect.
- E. Verification Samples: Actual size of all variations; to illustrate pattern, color variations, and grout joint size variations.
- F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- G. Installer's Qualification Statement:
 - 1. Submit documentation of National Tile Contractors Association (NTCA) or Tile Contractors' Association of America (TCAA) accreditation; www.tile-assn.com/#sle
- H. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.

1.7 QUALITY ASSURANCE

- A. Maintain one copy of ANSI A108/A118/A136, TCNA (HB), and TCNA (HB-GP) on-site.
- B. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum five years of documented experience.
- C. Installer Qualifications:
 - 1. Company specializing in performing tile installation, with minimum of five years of documented experience.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.9 FIELD CONDITIONS

- A. Do not install solvent-based products in an unventilated environment.
- B. Maintain ambient and substrate temperature above 50 degrees F (10 degrees C) and below 100 degrees F (38 degrees C) during installation and curing of setting materials.

PART 2 PRODUCTS

2.1 MANUFACTURER

- A. The manufacturer and basis of design shall be the following however products of other manufacturers listed will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product.
 - 1. Wall Tile, Wall Tile and Porcelain Base: Dal-Tile Corporation: www.daltile.com/#sle.
 - 2. Floor Tile and Quarry Tile Base: Crossville.
- B. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product:
 - 1. Emser Tile, LLC: www.emser.com/#sle.

2. Florida Tile.

C. Substitutions: See Section 016000 - Product Requirements for substitution procedures.

2.2 TILE

A. Products: All products of each type by the same manufacturer.

B. Wall Tile: (CWT-1)

1. Basis of Design: Linear "Color Wheel Linear" collection manufactured by Daltile..
2. Size: 4-inch x 12-inch.
3. Thickness: 5/16-inch.
4. Color: Artic White Semi Gloss.
5. Trim: Schluter quarter round trim at all outside corners.
6. Schluter Vove trim where PP floor tile meets CWT.
7. Grout: Epoxy.
 - a. Basis of Design: Mapei Avalanche.

C. Porcelain Floor Tile:(PP-1, PP-2)

1. Basis of Design: "Owens Stone" as manufactured by Crossville.
2. Color:
 - a. PP-1: Down.
 - b. PP-2: Sable.
3. Size: 12-inches x 24-inches.
4. Thickness:9.5 MM.
5. Finish: LTR.
6. Grout: Epoxy.
 - a. Manufacturer:Mapei.
 - b. Color:Gray.
 - c. Joint: 3 MM.
7. Trim: Schluter Cove trim at PP.

D. Quarry Floor Tile: (QT-1)

1. Basis of Design: "Quarry Textures - Smooth" collection as manufactured by Daltile.
2. Color: Ashen Gray.
3. Size:6-inches x 6-inches.
4. Thickness: 1/2-inch.
5. Grout: Epoxy.
 - a. Manufacturer:Mapei.
 - b. Color: Drfitwood.
 - c. Joint: 3/8-inch.

E. Porcelain Tile Base: (PP-1)

1. Basis of Design: "Owens Stone Cove" collection manufactured by Crossville.
2. Size: 6-inch x 12-inch.
3. Color: Sable.
4. Grout: Epoxy.
 - a. Manufacturer: Mapei.
 - b. Color: Gray.
 - c. Grout Joint: 3MM.

F. Quarry Tile Base: (QT-1)

1. Basis of Design:"Quarry Textures Cove" collection manufactured by Daltile.
2. Size: 5-inch x 6-inch.
3. Color: Ashen Gray.
4. Grout: Epoxy
 - a. Manufacturer: Mapei.

- b. Color: Drfitwood.
- c. Grout Joint: 3/8-inch.

2.3 SETTING MATERIALS

- A. Provide setting and grout materials from same manufacturer.
- B. The manufacturer and basis of design shall be the following however products of other manufacturers listed will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product.
 - 1. Mapei Corporation: www.mapei.com/#sle.
 - 2. Substitutions: See Section 016000- Substitution Procedures.
- C. Epoxy Adhesive and Mortar Bond Coat: ANSI A118.3.
 - 1. Applications: Where indicated on drawings.
 - 2. Basis of Design Products: Kerapoxy 410.

2.4 GROUTS

- A. Provide setting and grout materials from same manufacturer.
- B. Manufacturers:
 - 1. Mapei Corporation: www.mapei.com/#sle.
 - 2. Substitutions: See Section 016000 - Substitution Procedures.
- C. Epoxy Grout: ANSI A118.3 chemical resistant and water-cleanable epoxy grout.
 - 1. Basis of Design Products: Mapei.
 - a. Color:(s) Refer to Material Finish Legend.

2.5 MAINTENANCE MATERIALS

- A. Tile Sealant: Gunnable, silicone, siliconized acrylic, or urethane sealant; moisture and mildew resistant type.
 - 1. Applications: Between tile and plumbing fixtures.
 - 2. Color(s): As selected by Architect from manufacturer's full line.
 - 3. Basis of Design Products:
 - a. Mapei Corporation; Mapesil T Plus: www.mapei.com/#sle.
 - b. Substitutions: See Section 016000 - Product Requirements for substitution procedures.

2.6 ACCESSORY MATERIALS

- A. Concrete Floor Slab Crack Isolation Membrane: Material complying with ANSI A118.12; not intended as waterproofing.
 - 1. Crack Resistance: No failure at 1/8 inch (3.2 mm) gap, minimum.
 - 2. Fluid or Trowel Applied Type:
 - a. Thickness: 20 mils (0.5 mm), maximum.
 - b. Products:
 - 1) Mapei Corporation; Mapelastic CI: www.mapei.com/#sle.
 - 2) Substitutions: See Section 016000 - Substitution Procedures.
- B. Edge Trim:
 - 1. Basis of Design: The basis of design product "Schiene" is manufactured by Schluter. Equal or better performing products of other manufacturers will be considered for acceptance by the Architect.
 - 2. Material: Extruded aluminum, satin nickel anodized aluminum finish, mechanically fastened, gluing is not permitted.
 - 3. Provide at all edges unless indicated otherwise.
- C. Corner Trim:
 - 1. Basis of Design: The basis of design product "Jolly" as manufactured by Schluter. Equal or better performing products of other manufacturers will be considered for acceptance by the Architect.

2. Material: Extruded aluminum, satin nickel anodized aluminum finish, mechanically fastened, gluing is not permitted.
 3. Provide at all outside corners unless indicated otherwise.
- D. Wall Trim:
1. Basis of Design: The basis of design product 1/2-inch Fry Reglet "Wall Reveal". Equal or better performing products of other manufacturers will be considered for acceptance by the Architect.
 2. Material: Extruded aluminum, satin nickel anodized aluminum finish, mechanically fastened, gluing is not permitted.
 3. Provide at all outside corners unless indicated otherwise.
- E. Grout Sealer: Manufacturer's standard product for cleaning, brightening, and sealing grout joints that does not change color appearance of grout.
1. Penetrating Sealer – for quarry and other Vitreous, Semi-Vitreous & Non – Vitreous Tile.
 2. Manufacturers and products are as indicated however equal or better performing products of other manufacturers will be considered for acceptance by the Architect.
 - a. Bonsal, W. R., Company; Exterior Grout Sealer.
 - b. Bostik: Ceramaseal grout sealer.
 3. Jamo Inc. Matte finish penetrating sealer.
 - a. Stonetech; BulletProof Sealer.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.
- C. Verify that subfloor surfaces are dust free and free of substances that could impair bonding of setting materials to subfloor surfaces.
- D. Cementitious Subfloor Surfaces: Verify that substrates are ready for tiling installation by testing for moisture and alkalinity (pH).
 1. Test in accordance with Section 09 05 61.
 2. Obtain instructions if test results are not within limits recommended by tiling material manufacturer and setting material manufacturer.
 3. Follow moisture and alkalinity remediation procedures in Section 09 05 61.

3.2 PREPARATION

- A. Protect surrounding work from damage.
- B. Vacuum clean surfaces and damp clean.
- C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.
- D. Prepare substrate surfaces for adhesive installation in accordance with adhesive manufacturer's instructions.

3.3 INSTALLATION - GENERAL

- A. Install tile, thresholds, and stair treads and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.20, manufacturer's instructions, and TCNA (HB) or TCNA (HB-GP) recommendations, as applicable.
- B. Lay tile to pattern indicated. 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 grout joints without voids, cracks, excess mortar or excess grout, or too little grout.
- E. Form internal angles square and external angles bullnosed.
- F. Sound tile after setting. Replace hollow sounding units.
- G. Keep control and expansion joints free of mortar, grout, and adhesive.
- H. Prior to grouting, allow installation to completely cure; minimum of 48 hours.
- I. Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.
- J. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

3.4 INSTALLATION - FLOORS - THIN-SET METHODS

- A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F116, organic adhesive, with epoxy grout.
 - 1. Where epoxy bond coat and grout are indicated, install in accordance with TCNA (HB) Method F131.

3.5 INSTALLATION - WALL TILE

- A. On exterior walls install in accordance with TCNA (HB) Method W202, thin-set over concrete and masonry.
- B. Over interior concrete and masonry install in accordance with TCNA (HB) Method W211, bonded mortar bed without membrane.

3.6 CLEANING

- A. Clean tile and grout surfaces.

3.7 PROTECTION

- A. Do not permit traffic over finished floor surface for 4 days after installation.

END OF SECTION

SECTION 09 51 00 - ACOUSTICAL CEILINGS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

- A. Suspended metal grid ceiling system.
- B. Acoustical units.

1.3 REFERENCE STANDARDS

- A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- C. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method; 2023.
- D. ASTM C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2022.
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
- F. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2022.
- G. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2024a.
- H. ASTM E795 - Standard Practices for Mounting Test Specimens during Sound Absorption Tests; 2023.
- I. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2023.
- J. ASTM E1414/E1414M - Standard Test Method for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum; 2021a.
- K. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth; 2024.

1.4 REFERENCES

- A. Refer to specification Section 014100 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 ADMINISTRATIVE REQUIREMENTS

- A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.
- B. Do not install acoustical units until after interior wet work is dry.

1.6 ACTION SUBMITTALS

- A. See Section 013000 – Administrative Requirements and Section 016000 – Product Requirements for submittal procedures.
- B. Shop Drawings: Indicate grid layout and related dimensioning, junctions with other ceiling finishes, and mechanical and electrical items installed in the ceiling.

- C. Product Data: Provide data on suspension system components and acoustical units.
- D. Evaluation Service Reports: Show compliance with specified requirements.
- E. Samples: Submit two full size samples illustrating material and finish of acoustical units.
- F. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
- G. Manufacturer's qualification statement.
- H. Maintenance Materials: Furnish the following for Town of Canton's use in maintenance of project.
 - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
 - 2. Extra Acoustical Units: Quantity equal to 5 percent of total installed.

1.7 QUALITY ASSURANCE

- A. Designer Qualifications for Seismic Design: Perform under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed at the State in which the Project is located.
- B. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.8 FIELD CONDITIONS

- A. Maintain uniform temperature of minimum 60 degrees F (16 degrees C), and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acoustic Tiles/Panels:
 - 1. Armstrong World Industries, Inc: www.armstrongceilings.com/#sle.
 - 2. Substitutions: See Section 01 25 00 - Substitution Procedures.
- B. Suspension Systems:
 - 1. Armstrong World Industries, Inc: www.armstrongceilings.com/#sle.
 - 2. Substitutions: See Section 01 25 13 - Substitution Procedures.

2.2 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Ceiling systems designed to withstand the effects of earthquake motions determined according to ASCE 7 for Seismic Design Category C and complying with the following:
 - 1. Local authorities having jurisdiction.

2.3 ACOUSTICAL UNITS

- A. Acoustical Units - General: ASTM E1264, Class A.
- B. Acoustical Panels, Type ACP-1: Painted mineral fiber, with the following characteristics:
 - 1. Classification: ASTM E1264 Type III.
 - 2. Size: 24 by 24 inches (610 by 610 mm).
 - 3. Thickness: 5/8 inch (16 mm).
 - 4. Panel Edge: Square Tegralar.
 - 5. Color: White.
 - 6. Suspension System: Exposed grid.
 - 7. Products: Refr to Finish Material Legend.
 - a. Substitutions: See Section 01 25 00 - Substitution Procedures.

2.4 SUSPENSION SYSTEM(S)

- A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold down clips, stabilizer bars, clips, and splices as required.
 - 1. Materials:
 - a. Steel Grid: ASTM A653/A653M, G30 coating, unless otherwise indicated.
- B. Exposed Suspension System: Hot-dip galvanized steel grid with steel cap.
 - 1. Application(s): Seismic.
 - 2. Structural Classification: Intermediate-duty, when tested in accordance with ASTM C635/C635M.
 - 3. Profile: Tee; 15/16 inch (24 mm) face width.
 - 4. Finish: Baked enamel.
 - 5. Color: White.
 - 6. Products:
 - a. Armstrong World Industries, Inc; Prelude XL: www.armstrongceilings.com/#sle.
 - b. Substitutions: See Section 01 25 13 - Substitution Procedures.

2.5 ACCESSORIES

- A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.
- B. Hanger Wire: 12 gauge, 0.08 inch (2 mm) galvanized steel wire.
- C. Seismic Clips: Manufacturer's standard clips for seismic conditions and to suit application.
- D. Intersection sleeve.
- E. Perimeter Moldings: Same metal and finish as grid.
 - 1. Angle Molding: L-shaped, for mounting at same elevation as face of grid.
 - 2. Channel Molding: U-shaped, for hold-down type installations.
 - 3. Acoustical Sealant For Perimeter Moldings: Non-hardening, non-skinning, for use in conjunction with suspended ceiling system.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that layout of hangers will not interfere with other work.

3.2 PREPARATION

- A. Install after major above-ceiling work is complete.
- B. Coordinate the location of hangers with other work.

3.3 INSTALLATION - SUSPENSION SYSTEM

- A. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions and as supplemented in this section.
- B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
- C. Locate system on room axis according to reflected plan.
- D. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
 - 1. Install in bed of acoustical sealant.
 - 2. Use longest practical lengths.
 - 3. Overlap and rivet corners.

- E. Suspension System, Non-Seismic: Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
- F. Seismic Suspension System, Seismic Design Category C: Hang suspension system independent of walls, columns, ducts, pipes and conduit. Maintain a 3/8 inch (9 mm) clearance between grid ends and wall.
- G. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
- H. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
- I. Support fixture loads using supplementary hangers located within 6 inches (152 mm) of each corner, or support components independently.
- J. Do not eccentrically load system or induce rotation of runners.

3.4 INSTALLATION - ACOUSTICAL UNITS

- A. Install acoustical units in accordance with manufacturer's instructions.
- B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
- C. Fit border trim neatly against abutting surfaces.
- D. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.
- E. Cutting Acoustical Units:
 - 1. Make field cut edges of same profile as factory edges.

3.5 TOLERANCES

- A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet (3 mm in 3 m).
- B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

3.6 CLEANING

- A. See Section 01 77 00 - Closeout Procedures for additional requirements.
- B. Clean surfaces.
- C. Replace damaged or abraded components.

END OF SECTION

SECTION 09 65 00 - RESILIENT FLOORING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications and the Sections included under Division 1, General Requirements and References are included. References are included.

1.2 SECTION INCLUDES

- A. Resilient tile flooring.
- B. Resilient base.
- C. Installation accessories.

1.3 RELATED REQUIREMENTS

- A. Section 09 05 61 - Common Work Results for Flooring Preparation: Removal of existing floor coverings, cleaning, and preparation.
- B. Section 09 05 61 - Common Work Results for Flooring Preparation: Concrete slab moisture and alkalinity testing and remediation procedures.

1.4 REFERENCE STANDARDS

- A. ASTM D6329 - Standard Guide for Developing Methodology for Evaluating the Ability of Indoor Materials to Support Microbial Growth Using Static Environmental Chambers; 1998 (Reapproved 2023).
- B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2022.
- C. ASTM F1066 - Standard Specification for Vinyl Composition Floor Tile; 2025.
- D. ASTM F1700 - Standard Specification for Solid Vinyl Floor Tile in Modular Format such as Tile(s) or Plank(s); 2024.
- E. ASTM F1861 - Standard Specification for Resilient Wall Base; 2021.
- F. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2023.
- G. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.
- H. NSF 332 - Sustainability Assessment for Resilient Floor Coverings; 2022.
- I. RFCI (RWP) - Recommended Work Practices for Removal of Resilient Floor Coverings; 2018.

1.5 REFERENCES

- A. Refer to specification Section 01 41 00 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.6 SUBMITTALS

- A. See Section 01 30 00 – Administrative Requirements and Section 01 60 00 – Product Requirements for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
- C. Shop Drawings: Indicate seaming plans and floor patterns.
- D. Verification Samples: Submit two samples, in size illustrating color and pattern for each resilient flooring product specified.

- E. Certification: Prior to installation of flooring, submit written certification by flooring manufacturer and adhesive manufacturer that condition of subfloor is acceptable.
- F. Manufacturer's Qualification Statement.
- G. Installer's Qualification Statement.
- H. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.
- I. Maintenance Materials: Furnish the following for Town of Canton's use in maintenance of project.
 - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
 - 2. Extra Flooring Material: 100 square feet of each type and color.
 - 3. Extra Wall Base: 30 linear feet of each type and color.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing specified flooring with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in installing specified flooring with minimum three years documented experience.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.
- B. Store all materials off of the floor in an acclimatized, weather-tight space.
- C. Maintain temperature in storage area between 55 degrees F (13 degrees C) and 90 degrees F (72 degrees C).
- D. Protect roll materials from damage by storing on end.
- E. Do not double stack pallets.

1.9 FIELD CONDITIONS

- A. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F (21 degrees C) to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F (13 degrees C).

PART 2 PRODUCTS

2.1 RESILIENT BASE

- A. Resilient Base - Type RES-1: ASTM F1861, Type TS, rubber, vulcanized thermoset; Style B, Cove.
 - 1. Manufacturers:
 - a. Tarkett Flooring; Baseworks: www.tarkett.com/#sle.
 - b. Substitutions: See Section 01 25 00 - Substitution Procedures.
 - 2. Height: 4 inches (100 mm).
 - 3. Length: Roll.
 - 4. Color: Black.

2.2 ACCESSORIES

- A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.
- B. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by flooring manufacturer.
- C. Corners: Pre-formed.
- D. Moldings, Transition and Edge Strips: Same material as flooring.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.

3.2 PREPARATION

- A. Prepare floor substrates for installation of flooring in accordance with Section 09 05 61.

3.3 INSTALLATION - GENERAL

- A. Starting installation constitutes acceptance of subfloor conditions.
- B. Install in accordance with manufacturer's written instructions.
- C. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.
- D. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

3.4 INSTALLATION - RESILIENT BASE

- A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches (45 mm) between joints.
- B. Miter internal corners. At external corners, use premolded units. At exposed ends, use premolded units.
- C. Install pre-molded pieces before installing straight pieces.
- D. Install base on solid backing. Bond tightly to wall and floor surfaces.
- E. Scribe and fit to door frames and other interruptions.

3.5 CLEANING

- A. Remove excess adhesive from floor, base, and wall surfaces without damage.
- B. Clean in accordance with manufacturer's written instructions.

3.6 PROTECTION

- A. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION

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SECTION 09 65 66 - RESILIENT ATHLETIC FLOORING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specification and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

- A. Fluid-applied polyurethane flooring over rubberized base mat.
- B. Painted game lines.

1.3 RELATED REQUIREMENTS

- A. Section 09 05 61 - Common Work Results for Flooring Preparation: Removal of existing floor coverings, cleaning, and preparation.

1.4 REFERENCE STANDARDS

- A. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2016 (Reapproved 2021).
- B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2022.
- C. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.
- D. ASTM F2772 - Standard Specification for Athletic Performance Properties of Indoor Sports Floor Systems; 2011 (Reapproved 2019).
- E. DIN EN 14904 - Surfaces for Sports Areas – Indoor Surfaces for Multi-Sports Use – Specification; 2006.

1.5 REFERENCES

- A. Refer to specification Section 01 41 00 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.6 ACTION SUBMITTALS

- A. See Section 01 30 00 – Administrative Requirements and Section 01 60 00 – Product Requirements for submittal procedures.
- B. Product Data: Manufacturer's printed data sheets for products specified.
- C. Shop Drawings: Fabrication and installation details, and layout, colors, and widths of game lines and equipment locations.
- D. Selection Samples: Manufacturer's color charts for flooring materials specified and game line paints, indicating full range of colors and textures available.
- E. Test Reports: Submit test reports showing compliance with ASTM F2772.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.
- B. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to project site in unopened containers clearly labeled with manufacturer's name and identification of contents.

- B. Store materials in dry and clean location until needed for installation. During installation, handle in a manner that will prevent marring and soiling of finished surfaces.

1.9 FIELD CONDITIONS

- A. Maintain temperature in spaces to receive adhesively installed resilient flooring within range of 70 to 95 degrees F (21 to 35 degrees C) for not less than 48 hours before the beginning of installation and for not less than 48 hours after installation has been completed. Subsequently, do not allow temperature in installed spaces to drop below 50 degrees F (10 degrees C) or to go above 100 degrees F (38 degrees C).

PART 2 PRODUCTS

2.1 FLUID-APPLIED ATHLETIC FLOORING

- A. Manufacturers: All products by the same manufacturer.
- B. The manufacturer and basis of design shall be the following however products of other manufacturers listed will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product.
 - 1. Polyturf Plus Pad and Pour
- C. Other manufacturers must have a minimum of five (5) years' experience manufacturing products meeting or exceeding the specifications and comply with Section 01600 requirements regarding substitutions to be considered including acceptance is provided by the Architect in writing prior to bidding.
- D. Substitutions: See Section 01 60 00 - Product Requirements.

2.2 PRODUCTS

- A. Polyurethane Flooring Over Rubberized Base Mat Assembly:
 - 1. Base Mat: 7 mm thick prefabricated recycled resilient sheet.
 - 2. Topcoat: Manufacturer's standard 2 mm polyurethane compound designed to seal base mat before application of resin topcoat.
 - 3. Topcoat: Protective color coat, 7 mils thick.
 - a. Color: Desert 1200-0015.
- B. Performance:
 - 1. Density in accordance with ASTM D297.
 - a. Base mat: 0.67 min g/cm.
 - 2. Tensile Strength in accordance with ASTM D412:
 - a. Base Mat: 88 psi.
 - b. Wear Coat: 3200 psi.
 - 3. Elongation in accordance with ASTM D412:
 - a. Base Mat: 48.5%.
 - b. Wear Coat: 340%.
- C. Game Lines: Manufacturer's standard pigmented polyurethane paint.
 - 1. Colors:
 - a. Basketball: Black 0091.
 - b. Volleyball: Green 0113.
 - c. Pickleball: White 0090.

2.3 ACCESSORIES

- A. Leveling Compound: Latex-modified cement formulation as recommended by flooring manufacturer for substrate conditions.
- B. Flooring Adhesive: Waterproof; types recommended by flooring manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates for conditions detrimental to installation of athletic flooring. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of athletic flooring to substrate.
- C. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).
 - 1. Test in accordance with Section 09 05 61.
 - 2. Test as Follows:
 - a. Internal Relative Humidity: ASTM F2170.
 - 3. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.

3.2 PREPARATION

- A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.
- B. Concrete: Use leveling compound as necessary to achieve substrate flatness of plus or minus 1/8 inch within 10 ft radius (1/1000).
- C. Remove coatings that are incompatible with flooring adhesives, using methods recommended by flooring manufacturer.
- D. Broom clean areas to receive athletic flooring immediately before beginning installation.

3.3 INSTALLATION

- A. Starting installation constitutes acceptance of subfloor conditions.
- B. Install in accordance with manufacturer's written instructions.
- C. Fluid-Applied Polyurethane Flooring Over Base Mat:
 - 1. Mix components in strict accordance with manufacturer's written instructions, and apply at manufacturer's recommended rates. Allow sufficient curing time between coatings.
 - 2. Unroll base mat and allow to relax before beginning installation.
 - 3. Apply adhesive to substrate with notched trowel, and roll base mat into fresh adhesive. Do not allow compression fit at any seams. Roll mat with weighted linoleum roller immediately upon application of base mat and again after 45 minutes to insure that base mat is firmly adhered to substrate.
 - 4. Thoroughly mix and apply seal coat to surface of base mat with steel trowel.
 - 5. Apply resin wear layer in number of lifts recommended by manufacturer, applying wet-into-wet to achieve a seamless surface. Sand any imperfections in surface after wear layer has cured.
 - 6. Thoroughly mix and apply finish coat with airless sprayer to achieve uniform appearance.
 - 7. Lay out game lines using tape and taping machine approved by flooring manufacturer. Apply game line paint with roller, and allow to dry before removing tape.
- D. Polyurethane Overlay Topping:
 - 1. Mix components in strict accordance with manufacturer's written instructions. Apply overlay topping at manufacturer's recommended rates using notched trowel or notched squeegee.
 - 2. Allow topcoat to cure. Apply polyurethane wear coat with paint roller or by airless spray.

3.4 CLEANING

- A. Clean flooring using methods recommended by manufacturer.

3.5 PROTECTION

- A. Protect finished athletic flooring from construction traffic to ensure that it is without damage upon Date of Substantial Completion.

END OF SECTION

SECTION 09 68 13 - TILE CARPETING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

- A. Carpet tile, fully adhered.

1.3 RELATED REQUIREMENTS

- A. Section 09 05 61 - Common Work Results for Flooring Preparation: Removal of existing floor coverings, cleaning, and preparation.

1.4 REFERENCE STANDARDS

- A. ASTM D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials; 2016 (Reapproved 2021).
- B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2022.
- C. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2023.
- D. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.
- E. CRI 104 - Standard for Installation of Commercial Carpet; 2015.

1.5 REFERENCES

- A. Refer to specification Section 01 41 00 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.6 ACTION SUBMITTALS

- A. See Section 01 30 00 – Administrative Requirements and Section 01 60 00 – Product Requirements for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.
- C. Shop Drawings: Indicate layout of joints.
- D. Samples: Submit two carpet tiles illustrating color and pattern design for each carpet color selected.
- E. Accessory Samples: Submit two samples of edge strip.
- F. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
- G. Manufacturer's Qualification Statement.
- H. Installer's Qualification Statement.
- I. Operation and Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.
- J. Maintenance Materials: Furnish the following for Town of Canton's use in maintenance of project.
 - 1. Extra Carpet Tiles: Quantity equal to 5 percent of total installed of each color and pattern installed.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing specified carpet tile with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in installing carpet tile with minimum three years documented experience and approved by carpet tile manufacturer.

1.8 FIELD CONDITIONS

- A. Store materials in area of installation for minimum period of 24 hours prior to installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. The manufacturer and basis of design shall be the following however products of other manufacturers listed will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product.
 - 1. Tarket; www.commercial.tarket.com.
- B. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product:
 - 1. Interface, Inc: www.interface.com/#sle.
 - 2. Mannington Commercial: www.manningtoncommercial.com#sle.
 - 3. Mohawk Group: www.mohawkgroup.com/#sle.
 - 4. Shaw Contract. www.shawcontract.com.
- C. Substitutions: See Section 016000 - Substitution Procedures.

2.2 MATERIALS

- A. Tile Carpeting: (EM-1)
 - 1. Product: Abrasive Action II #02578.
 - 2. Tile Size: 24-inch by 24-inch, nominal.
 - 3. Construction: Paterned loop.
 - 4. Face Weight: 24 oz/sy.
 - 5. Gauge: 1/12.
 - 6. Tuft Density: 96.
 - 7. Pile Thickness: 0.115-inch.
 - 8. Smoke Generation: Less than 450 in accordance with ASTM E-662.
 - 9. Antimicrobial: No antimicrobials added to product.
 - 10. Color: As selected by Architect from manufacturer's full range.

2.3 ACCESSORIES

- A. Subfloor Filler: White premix latex; type recommended by flooring material manufacturer.
- B. Edge Strips: Vinyl, color as selected by Architect.
- C. Carpet Tile Adhesive: Recommended by carpet tile manufacturer; releasable type.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that subfloor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.
- B. Cementitious Subfloor Surfaces: Verify that substrates are ready for flooring installation by testing for moisture and alkalinity (pH).
 - 1. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.
 - 2. Follow moisture and alkalinity remediation procedures in Section 09 05 61.

3.2 PREPARATION

- A. Prepare floor substrates for installation of flooring in accordance with Section 09 05 61.

3.3 INSTALLATION

- A. Starting installation constitutes acceptance of subfloor conditions.
- B. Install carpet tile in accordance with manufacturer's instructions.
- C. Blend carpet from different cartons to ensure minimal variation in color match.
- D. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.
- E. Locate change of color or pattern between rooms under door centerline.
- F. Trim carpet tile neatly at walls and around interruptions.
- G. Complete installation of edge strips, concealing exposed edges.

3.4 CLEANING

- A. Remove excess adhesive without damage, from floor, base, and wall surfaces.
- B. Clean and vacuum carpet surfaces.

END OF SECTION

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SECTION 09 91 13 - EXTERIOR PAINTING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specification and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
- D. Do Not Paint or Finish the Following Items:
 - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
 - 2. Items indicated to receive other finishes.
 - 3. Items indicated to remain unfinished.

1.3 RELATED REQUIREMENTS

- A. Section 092423 - Portland Cement Stucco.
- B. Section 09 91 23 - Interior Painting.

1.4 DEFINITIONS

- A. Comply with ASTM D16 for interpretation of terms used in this section.

1.5 REFERENCE STANDARDS

- A. NACE International (National Association of Corrosion Engineers) – Industrial Maintenance Painting.
- B. NPCA (National Paint and Coatings Association) – Guide to U.S. Government Paint Specifications.
- C. Paint – Certified Product List - Florida Department of Agriculture and Consumer Services.
- D. PDCA (Painting and Decorating Contractors of America) – Architectural Painting Specifications Manual.
- E. PDCA Standard P1-04 Touchup Painting and Damage Repair; Financial Responsibility.
- F. PDCA Standard P5-04 Benchmark Sample Procedures for Paint and other Decorative Coating System.
- G. SSPC (Steel Structures Painting Council) – Steel Structures Painting Manual.
- H. SSPC-SP 1 – Solvent Cleaning.
- I. Modern Guide to Paint Specifications (current edition) – Standard Type 1.
- J. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2024.
- K. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.
- L. SCAQMD 1113 - Architectural Coatings; 1977, with Amendment (2016).
- M. SSPC V1 (PM1) - Good Painting Practice: Painting Manual Volume 1; 2024.

1.6 REFERENCES

- A. Refer to specification Section 014000 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.7 ACTION SUBMITTALS

- A. See Section 013000 – Administrative Requirements and Section 016000 – Product Requirements for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
 - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
 - 2. MPI product number (e.g. MPI #47).
 - 3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
 - 4. Manufacturer's installation instructions.
- C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches (216 by 279 mm) in size, illustrating range of colors available for each finishing product specified.
 - 1. Where sheen is specified, submit samples in only that sheen.
- D. Certification: By manufacturer that paints and finishes comply with VOC limits specified.
- E. Manufacturer's Instructions: Indicate special surface preparation procedures.
- F. Maintenance Materials: Furnish the following for Town of Canton's use in maintenance of project.
 - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
 - 2. Extra Paint and Finish Materials: 1 gallon (4 L) of each color; from the same product run, store where directed.
 - 3. Label each container with color in addition to the manufacturer's label.

1.8 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.10 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the paint product manufacturer's temperature ranges.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Do not apply exterior paint and finishes during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.
- D. Minimum Application Temperatures for Latex Paints: 50 degrees F (10 degrees C) for exterior; unless required otherwise by manufacturer's instructions.
- E. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surface.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturer and basis of design shall be as indicated on "Finish Material Legend" however products of other manufacturers will be considered for acceptance provided they equal or exceed

the material requirements and functional qualities of the specified product and acceptance is provided by the Architect in writing prior to bidding.

1. Sherwin William
- B. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product:
 1. Benjamin Moore & Co.
 2. Pittsburgh Paints Co.
 3. Pratt & Lambert
- C. Single Source: Provide primers and undercoat paint produced by the same manufacturer as the finish coat.

2.2 COMPATIBILITY

- A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists.
- B. Paint materials and equipment shall be compatible in use; finish coats shall be compatible with prime coats; prime coats shall be compatible with the surface to be coated; tools and equipment shall be compatible with the coating to be applied.
 1. Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristic of finish materials to ensure use of compatible primers.
 2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
- C. Thinners, when used, shall be only those thinners recommended for that purpose by the manufacturer of the material to be thinned.
- D. The term "paint," as used herein, includes enamels, paints, sealers, stains, fillers, emulsions, and other coatings, whether used as prime, intermediate, or finish coats.

2.3 PAINTS AND FINISHES - GENERAL

- A. Paints and Finishes: Ready-mixed, unless required to be a field-catalyzed paint.
 1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
 2. Supply each paint material in quantity required to complete entire project's work from a single production run.
 3. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is described explicitly in manufacturer's product instructions.

2.4 PAINT SYSTEMS - EXTERIOR

- A. Portland Cement Plaster Substrates:
 1. Latex System:
 - a. Prime Coat: Primer, Alkali Resistant, Water Based, exterior, MPI #3.
 - b. Intermediate Coat: Latex, exterior, matching topcoat.
 - c. Topcoat: Latex, exterior, flat (Gloss Level 1), MPI #10.
- B. Steel Substrates:
 1. Latex over Alkyd Primer System:
 - a. Prime Coat: Primer, alkyd, anti-corrosive, for metal, MPI #79.
 - b. Intermediate Coat: Latex, exterior, matching topcoat.
 - c. Topcoat: Latex, exterior, semi-gloss, (Gloss Level 5), MPI #11.
- C. Aluminum (Not Anodized or Otherwise Coated) Substrates:
 1. Latex System:
 - a. Prime Coat: Primer, quick dry, for aluminum, MPI #95.

- b. Intermediate Coat: Latex, exterior, matching topcoat.
- c. Topcoat: Latex, exterior, semi-gloss, (Gloss Level 5), MPI #11.

2.5 MATERIALS – GENERAL REQUIREMENTS

- A. Paints and Coatings – General
 - 1. Unless otherwise indicated, provide factory-mixed coatings.
 - 2. When required, mix coatings to correct consistency in accordance with manufacturer's instructions before application.
 - 3. Do not reduce, thin, or dilute coatings or add materials to coatings unless approved in manufacturer's product instructions.
 - 4. Confirm VOC's need by using the products MSDS sheets.
- B. Primers: Where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.

2.6 ACCESSORIES

- A. Coating application accessories: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required, per manufacturer's specifications.

2.7 ACCESSORY MATERIALS

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.
- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- C. Test shop-applied primer for compatibility with subsequent cover materials.
- D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
 - 1. Exterior Plaster and Stucco: 12 percent.

3.2 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.
- D. Seal surfaces that might cause bleed through or staining of topcoat.
- E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- F. Exterior Plaster: Fill hairline cracks, small holes, and imperfections with exterior patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.

3.3 APPLICATION

- A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

- C. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.
- D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- E. Apply each coat to uniform appearance.
- F. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- G. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.4 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.5 PROTECTION

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

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SECTION 09 91 23 - INTERIOR PAINTING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
 - 1. Mechanical and Electrical:
 - a. In finished areas, paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, unless otherwise indicated.
 - b. In finished areas, paint shop-primed items.
- D. Do Not Paint or Finish the Following Items:
 - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
 - 2. Items indicated to receive other finishes.
 - 3. Items indicated to remain unfinished.
 - 4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
 - 5. Floors, unless specifically indicated.
 - 6. Glass.
 - 7. Concealed pipes, ducts, and conduits.

1.3 DEFINITIONS

- A. Comply with ASTM D16 for interpretation of terms used in this section.

1.4 REFERENCE STANDARDS

- A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; Current Edition.
- B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2024.
- C. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association; Current Edition.
- D. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.
- E. SCAQMD 1113 - Architectural Coatings; 1977, with Amendment (2016).
- F. SSPC V1 (PM1) - Good Painting Practice: Painting Manual Volume 1; 2024.
- G. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).
- H. SSPC-SP 6/NACE No.3 - Commercial Blast Cleaning; 2006.
- I. SSPC-SP 13/NACE No.6 - Surface Preparation of Concrete; 2018.

1.5 REFERENCES

- A. Refer to specification Section 014100 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.6 ACTION SUBMITTALS

- A. See Section 013000 – Administrative Requirements and Section 016000 – Product Requirements for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
 - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g., "alkyd enamel").
 - 2. MPI product number (e.g., MPI #47).
 - 3. Cross-reference to specified paint system products to be used in project; include description of each system.
 - 4. Manufacturer's installation instructions.
 - 5. If proposal of substitutions is allowed under submittal procedures, explanation of substitutions proposed.
 - 6. Include corresponding paint number form Finish Legend.
- C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches (216 by 279 mm) in size, illustrating range of colors available for each finishing product specified.
 - 1. Where sheen is specified, submit samples in only that sheen.
 - 2. Where sheen is not specified, discuss sheen options with Architect before preparing samples, to eliminate sheens not required.
 - 3. Allow 30 days for approval process, after receipt of complete samples by Architect.
 - 4. Paint color submittals will not be considered until color submittals for major materials not to be painted, such as masonry, have been approved.
 - 5. Include corresponding paint number form Finish Legend.
- D. Certification: By manufacturer that paints and finishes comply with VOC limits specified.
- E. Manufacturer's Instructions: Indicate special surface preparation procedures.
- F. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.
- G. Maintenance Materials: Furnish the following for Town of Canton's use in maintenance of project.
 - 1. Extra Paint and Finish Materials: 1 gal (4 L) of each color; from the same product run, store where directed.
 - 2. Label each container with color in addition to the manufacturer's label.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum five years documented experience.

1.8 MOCK-UP

- A. See Section 01 40 00 - Quality Requirements, for general requirements for mock-up.
- B. Provide panel, 4 feet long by 4 wide, illustrating paint color, texture, and finish.
- C. Provide door and frame assembly illustrating paint color, texture, and finish.
- D. Locate where directed by Architect.
- E. Mock-up may remain as part of the work.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.10 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Do not apply materials when relative humidity exceeds 85 percent, at temperatures less than 5 degrees F (3 degrees C) above the dew point, or to damp or wet surfaces.
- D. Minimum Application Temperatures for Paints: 50 degrees F (10 degrees C) for interiors unless required otherwise by manufacturer's instructions.
- E. Provide lighting level of 80 fc (860 lux) measured mid-height at substrate surface.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.
- B. The manufacturer and basis of design shall be the following however products of other manufacturers listed will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product.
 - 1. Sherwin-Williams Company: www.sherwin-williams.com/#sle.
- C. Primer Sealers: Same manufacturer as top coats.
- D. Substitutions: See Section 016000 - Product Requirements for substitution procedures.

2.2 PAINTS AND FINISHES - GENERAL

- A. Paints and Finishes: Ready-mixed, unless intended to be a field-catalyzed paint.
 - 1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
 - 2. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
 - 3. Supply each paint material in quantity required to complete entire project's work from a single production run.
 - 4. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
- B. Flammability: Comply with applicable code for surface burning characteristics.
- C. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.
- D. Colors: To be selected from manufacturer's full range of available colors.
 - 1. Selection to be made by Architect after award of contract.
 - 2. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling under which they are mounted.

2.3 PAINT SYSTEMS - INTERIOR

- A. Interior Surfaces to be Painted, Unless Otherwise Indicated: Including gypsum board, concrete masonry units, uncoated steel, shop primed steel, and galvanized steel.
 - 1. Two top coats and one coat primer.
 - 2. Top Coat(s): High Performance Architectural Interior Latex; MPI #138, 139, 140, 141, or 142.
 - 3. Primer: As recommended by top coat manufacturer for specific substrate.
- B. Medium Duty Door/Trim: For surfaces subject to frequent contact by occupants, including metals:
 - 1. Two top coats and one coat primer.
 - 2. Top Coat(s): High Performance Architectural Interior Latex; MPI #138, 139, 140, 141, or 142.
 - a. Products:
 - 1) Sherwin-Williams Pro Industrial Pre-Catalyzed Waterbased Epoxy, Semi-Gloss. (MPI #141)
 - 3. Primer: As recommended by top coat manufacturer for specific substrate.
- C. Paint I-OP-MD-WC - Medium Duty Vertical and Overhead: Including gypsum board.
 - 1. Top Coat(s): Interior Alkyd, Water Based; MPI #157, 167, 168, or 169.
 - a. Products:
 - 1) Sherwin-Williams ProMar 200 Waterbased Acrylic-Alkyd, Eg-Shel.
 - 2. Top Coat Sheen:
 - a. Eggshell: MPI gloss level 3; use this sheen at all locations.

2.4 PRIMERS

- A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.
 - 1. Alkali Resistant Water Based Primer; MPI #3.
 - a. Products:
 - 1) Sherwin-Williams Loxon Water Blocking Primer/Finish.
 - 2) Substitutions: See Section 01 60 00 - Product Requirements
 - 2. Interior/Exterior Latex Block Filler; MPI #4.
 - a. Products:
 - 1) Sherwin-Williams Loxon Block Surfacer. (MPI #4)
 - 2) Substitutions: See Section 01 60 00 - Product Requirements
 - 3. Interior Rust-Inhibitive Water Based Primer; MPI #107.
 - a. Products:
 - 1) Sherwin-Williams Pro-Cryl Universal Primer. (MPI #107)
 - 2) Substitutions: See Section 01 60 00 - Product Requirements

2.5 ACCESSORY MATERIALS

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.
- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- C. Test shop-applied primer for compatibility with subsequent cover materials.

- D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces is below the following maximums:
 - 1. Gypsum Wallboard: 12 percent.
 - 2. Masonry, Concrete, and Concrete Masonry Units: 12 percent.

3.2 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
- D. Seal surfaces that might cause bleed through or staining of topcoat.
- E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- F. Concrete:
 - 1. Prepare surface as recommended by top coat manufacturer and in accordance with SSPC-SP 13/NACE No.6.
- G. Masonry:
 - 1. Remove efflorescence and chalk. Do not coat surfaces if moisture content, alkalinity of surfaces, or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
 - 2. Prepare surface as recommended by top coat manufacturer.
- H. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.
- I. Galvanized Surfaces:
 - 1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
- J. Ferrous Metal:
 - 1. Solvent clean according to SSPC-SP 1.
 - 2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
 - 3. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning in accordance with SSPC-SP 6/NACE No.3. Protect from corrosion until coated.

3.3 APPLICATION

- A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- D. Apply each coat to uniform appearance in thicknesses specified by manufacturer.
- E. Sand wood and metal surfaces lightly between coats to achieve required finish.
- F. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- G. Wood to Receive Transparent Finishes: See Section 09 93 00.
- H. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.4 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for general requirements for field inspection.

3.5 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.6 PROTECTION

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

SECTION 10 14 19 - DIMENSIONAL LETTER SIGNAGE

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specification and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

- A. Dimensional letter signage.

1.3 REFERENCES

- A. Refer to specification Section 01 41 00 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.4 ACTION SUBMITTALS

- A. See Section 01 30 00 – Administrative Requirements and Section 01 60 00 - Product Requirements for submittal procedures.
- B. Product Data: Manufacturer's product literature for each type of dimensional letter sign, indicating style, font, colors, locations, and overall dimensions of each sign.
- C. Shop Drawings:
 - 1. Include dimensions, locations, elevations, materials, text and graphic layout, and attachment details.
- D. Samples: Submit one sample of each type of dimensional letter sign of size similar to that required for project, indicating sign style, font, and method of attachment.
- E. Verification Samples: Submit samples showing colors and finishes specified.
- F. Manufacturer's Installation Instructions: Include installation templates and attachment devices.
- G. Manufacturer's qualification statement.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Package dimensional letter signs as required to prevent damage before installation.
- B. Store under cover and elevated above grade.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Dimensional Letter Signs:
 - 1. A.R.K. Ramos: www.arkramos.com/#sle.
 - 2. CityScapes Inc: www.cityscapesinc.com/#sle.
 - 3. Takeform: www.takeform.net/#sle.

2.2 DIMENSIONAL LETTERS

- A. Applications: Interior Building identification.
 - 1. Use individual metal letters.
 - 2. Mounting Location: Interior as indicated on drawings.
- B. Metal Letters:
 - 1. Material: Aluminum casting.
 - 2. Thickness: Manufacturer's standard for letter size.

3. Letter Height: 6-inch.
4. Text and Typeface:
 - a. Character Font: Century Gothic..
 - b. Character Case: Upper case only or as selected by the Architect.
5. Finish: Dark bronze.
6. Mounting: Concealed screws.

2.3 ACCESSORIES

- A. Concealed Screws: Noncorroding metal; stainless steel.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that substrate surfaces are ready to receive work.
- B. Notify Architect if conditions are not suitable for installation of signs; do not proceed until conditions are satisfactory.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install with horizontal edges level.

END OF SECTION

SECTION 10 14 23 - PANEL SIGNAGE

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specification and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

- A. Panel signage.

1.3 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- B. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

1.4 REFERENCES

- A. Refer to specification Section 01 41 00 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 SUBMITTALS

- A. See Section 01 30 00 – Administrative Requirements and Section 01 60 00 – Product Requirements for submittal procedures.
- B. Product Data: Manufacturer's product literature for each type of panel sign, indicating styles, font, foreground and background colors, locations, and overall dimensions of each sign.
- C. Shop Drawings:
 - 1. Include dimensions, locations, elevations, materials, text and graphic layout, attachment details, and schedules.
 - 2. Schedule: Provide information sufficient to completely define each panel sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
 - a. When room numbers to appear on signs differ from those on drawings, include the drawing room number on schedule.
 - b. When content of signs is indicated to be determined later, request such information from Town of Canton through Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
 - c. Submit for approval by Town of Canton through Architect prior to fabrication.
- D. Samples: Submit two samples of each type of sign, of size similar to that required for project, indicating sign style, font, and method of attachment.
- E. Verification Samples: Submit samples showing colors, materials, and finishes specified.
- F. Manufacturer's Installation Instructions: Include installation templates and attachment devices.
- G. Manufacturer's qualification statement.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Package signs as required to prevent damage before installation.
- B. Package room and door signs in sequential order of installation, labeled by floor or building.
- C. Store tape adhesive at normal room temperature.

1.8 FIELD CONDITIONS

- A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.
- B. Maintain minimum ambient temperature during and after installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Panel Signage (Match existing signage);
 - 1. Best Sign Systems, Inc: www.bestsigns.com/#sle.
 - 2. Inpro Corporation: www.inprocorp.com/#sle.
 - 3. Vista System LLC: www.vistasystem.com/#sle.
 - 4. Substitutions: See Section 01 60 00 - Product Requirements.

2.2 REGULATORY REQUIREMENTS

- A. Accessibility Requirements: Comply with ADA Standards and ICC A117.1 and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most restrictive requirements.

2.3 PANEL SIGNAGE

- A. Panel Signage:
 - 1. Application: Room and door signs.
 - 2. Description: Flat signs with applied character panel media, tactile characters.
 - 3. Sign Size: 6 1/2 inches high by 8 inches wide.
 - 4. Total Thickness: 1/4 inch.
 - 5. Sign Edges: Squared.
 - 6. Corners: Squared.
 - 7. Colors and Fonts: As selected by Architect from Manufacturer's full range.
 - a. Character Case: Upper and lower case (title case).
 - 8. Material: One-piece injection molded acrylic plastic with raised letters and braille.
 - 9. Profile: Flat panel without frame.
 - 10. Tactile Letters: Raised 1/32 inch minimum.
 - 11. Braille: Grade II, ADA-compliant.
 - 12. One-Sided Wall Mounting: Tape adhesive.

2.4 SIGNAGE APPLICATIONS

- A. Room and Door Signs:
 - 1. General includeing Office Doors, Gymnasium, Multi Purpose Rooms and other Spaces requiring signage: Identify with room names and numbers to be determined later, not those indicated on drawings; provide "window" section for replaceable occupant name.
 - 2. Service Rooms: Identify with room names and numbers to be determined later, not those indicated on drawings.
 - 3. Rest Rooms: Identify with pictograms, the names "MEN" and "WOMEN", room numbers to be determined later, and braille.

2.5 ACCESSORIES

- A. Tape Adhesive: Double-sided tape, permanent adhesive.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that substrate surfaces are ready to receive work.
- B. Notify Architect if conditions are not suitable for installation of signs; do not proceed until conditions are satisfactory.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install with horizontal edges level.
- C. Locate panel signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.
- D. Protect from damage until mm-dd-yyyy; repair or replace damaged items.

END OF SECTION

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SECTION 10 21 13.19 - PLASTIC TOILET COMPARTMENTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

- A. Solid plastic toilet compartments.
- B. Urinal screens.

1.3 REFERENCE STANDARDS

- A. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
- C. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth; 2024.

1.4 REFERENCES

- A. Refer to specification Section 01 41 00 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 SUBMITTALS

- A. See Section 01 30 00 – Administrative Requirements and Section 01 60 00 – Product Requirements for submittal procedures.
- B. Product Data: Provide data on panel construction, hardware, and accessories.
- C. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall and floor supports, door swings.
- D. Samples: Submit two samples of partition panels, in size illustrating panel finish, color, and sheen.
- E. Manufacturer's Installation Instructions: Indicate special procedures.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. The manufacturer and basis of design shall be the following however products of other manufacturers listed will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product.
- B. Solid Plastic Toilet Compartments:
 - 1. ASI Global Partitions; Solid Plastic HDPE: www.asi-globalpartitions.com/#sle.
- C. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product:
 - 1. Hadrian; Hadrian - Standard Series - Plastic: www.hadrian-inc.com/#sle.
 - 2. Partition Systems International of South Carolina; PolyLife HDPE Toilet Partitions: www.psisc.com/#sle.
 - 3. Scranton Products; Hiny Hiders Partitions: www.scrantonproducts.com/#sle.
- D. Substitutions: See Section 01 60 00 - Product Requirements for substitution procedures.

2.2 PLASTIC TOILET COMPARTMENTS

- A. Solid Plastic Toilet Compartments: Factory fabricated doors, pilasters, and divider panels made of solid molded high density polyethylene (HDPE), tested in accordance with NFPA 286; floor-mounted headrail-braced.
- B. Basis of Design Product:
 - 1. "Integrated Privacy" Series.
 - 2. Texture: As selected by Architech from manufacturer's full range.
 - 3. Color: As selected by Architech from manufacturer's full range.
 - 4. Doors:
 - a. Thickness: Manufacturer's standard.
 - b. Width: 24 inch (610 mm).
 - c. Width for Handicapped Use: 36 inch (915 mm), out-swinging.
 - d. Height: 72 inch (1829 mm).
 - 5. Panels:
 - a. Thickness: 1 inch (25 mm).
 - b. Height: 72 inch (1829 mm).
 - c. Depth: As indicated on drawings.
 - 6. Pilasters:
 - a. Thickness: 1 inch (25 mm).
 - b. Width: As required to fit space; minimum 3 inch (76 mm).
 - c. Height: 84 inches (2134 mm).
 - 7. Screens: Without doors; to match compartments; mounted to wall with continuous panel brackets.

2.3 ACCESSORIES

- A. Pilaster Shoes: Stainless steel, satin finish, 3 inches (76 mm) high; concealing floor fastenings.
 - 1. Provide adjustment for floor variations with screw jack through steel saddles integral with pilaster.
- B. Head Rails: Extruded aluminum, anti-grip profile.
 - 1. Size: Manufacturer's standard size.
- C. Wall and Pilaster Brackets: Stainless steel; manufacturer's standard type for conditions indicated on drawings.
- D. Attachments, Screws, and Bolts: Stainless steel , tamper proof type.
- E. Hinges: Stainless steel, manufacturer's standard finish.
 - 1. Pivot hinges, gravity type, adjustable for door close positioning; two per door.
- F. Door Hardware: Stainless steel, manufacturer's standard finish.
 - 1. Door Latch: Slide type with exterior emergency access feature.
 - 2. Door Strike and Keeper with Rubber Bumper: Mount on pilaster in alignment with door latch.
 - 3. Provide door pull for outswinging doors.
- G. Coat Hook: One per compartment, mounted on door.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify correct spacing of and between plumbing fixtures.

3.2 INSTALLATION

- A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.
- B. Maintain 3/8 inch to 1/2 inch (9 mm to 13 mm) space between wall and panels and between wall and end pilasters.
- C. Attach panel brackets securely to walls using anchor devices.

- D. Attach panels and pilasters to brackets. Locate head rail joints at pilaster center lines.
- E. Field touch-up of scratches or damaged finish will not be permitted. Replace damaged or scratched materials with new materials.

3.3 TOLERANCES

- A. Maximum Variation From True Position: 1/4 inch (6 mm).
- B. Maximum Variation From Plumb: 1/8 inch (3 mm).

3.4 ADJUSTING

- A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch (5 mm).
- B. Adjust hinges to position doors in partial opening position when unlatched. Return out-swinging doors to closed position.

END OF SECTION

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SECTION 10 28 00 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

- A. Commercial toilet accessories.
- B. Under-lavatory pipe supply covers.
- C. Diaper changing stations.
- D. Utility room accessories.

1.3 ABBREVIATIONS AND ACRONYMS

- A. PETG: Polyethylene Terephthalate Glycol.
- B. PPE: Personal Protective Equipment.

1.4 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- B. ASME A112.18.9 - Protectors/Insulators for Exposed Waste and Supplies on Accessible Fixtures; 2011 (Reaffirmed 2022).
- C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- D. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2022.
- E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- F. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.
- G. ASTM B86 - Standard Specification for Zinc and Zinc-Aluminum (ZA) Alloy Foundry and Die Castings; 2023.
- H. ASTM B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium; 2017 (Reapproved 2022).
- I. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror; 2024.
- J. ASTM C1822 - Standard Specification for Insulating Covers on Accessible Lavatory Piping; 2021.
- K. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
- L. ASTM F2285 - Standard Consumer Safety Performance Specification for Diaper Changing Tables for Commercial Use; 2022.
- M. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).
- N. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

1.5 REFERENCES

- A. Refer to specification Section 01 41 00 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.6 PERFORMANCE REQUIREMENTS

- A. Grab Bars:
 - 1. Grab bars and any wall or other surfaces adjacent to grab bars shall be free of sharp or abrasive elements and shall have rounded edges.

1.7 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the work with the placement of reinforcement of toilet partitions to receive anchor attachments.

1.8 ACTION SUBMITTALS

- A. See Section 01 30 00 – Administrative Requirements and Section 01 60 00 – Product Requirements for submittal procedures.
- B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.
 - 1. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
- C. Product Schedule: Show types, quantities, sizes and installation locations by room of each accessory required. Identify locations using room designations indicated.
- D. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.
- E. Maintenance Data: Submit for inclusion in maintenance manuals.

1.9 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Accessibility Requirements: Comply with applicable requirements.
 - a. U.S. Architectural and Transportation Barriers Compliance Board, Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAGG).
 - b. ICC/ANSI A117.1 Accessible and Useable Buildings and Facilities.

1.10 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities and for proper installation, adjustment, operation, cleaning and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.11 WARRANTY

- A. Mirrors: Written warranty signed by manufacturer in which manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within warranty period.
 - 1. Failures include, but are not limited to, visible silver spoilage defects.
 - 2. Warranty Period: 15 years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. The manufacturer and basis of design shall be the following however products of other manufacturers listed will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product.
- B. Commercial Toilet, Shower, and Bath Accessories:
 - 1. Accessories where indicated: Bobrick Washroom Equipment, Inc.
 - 2. Diaper Changing Stations: Koala Kare Products, a division of Bobrick.
- C. Substitutions: See Section 01 60 00 - Product Requirements for substitution procedures.

2.2 MATERIALS

- A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
 - 1. Grind welded joints smooth.
 - 2. Fabricate units made of metal sheet of seamless sheets with flat surfaces.
- B. Keys: Provide keys for each accessory to Town of Canton; master key lockable accessories.
- C. Stainless Steel Sheet: ASTM A666/A666M, Type 304.
- D. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.
- E. Galvanized Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.
- F. Zinc Alloy: Die cast, ASTM B86.
- G. Adhesive: Two component epoxy type, waterproof.
- H. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.
- I. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

2.3 FABRICATION

- A. Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.
- B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

2.4 FINISHES

- A. Stainless Steel: Satin finish, unless otherwise noted.
- B. Chrome/Nickel Plating: ASTM B456, SC 2, polished finish, unless otherwise noted.
- C. Baked Enamel: Pretreat to clean condition, apply one coat primer and minimum two coats epoxy baked enamel.
- D. Powder-Coated Steel: Clean, degrease, and neutralize. Follow immediately with a phosphatizing treatment, prime coat, and two finish coats of powder coat enamel.
- E. Galvanizing for Items Other than Sheet: Comply with ASTM A123/A123M; galvanize ferrous metal and fastening devices.
- F. Shop Primed Ferrous Metals: Pretreat and clean, spray apply one coat primer and bake.
- G. Back paint components where contact is made with building finishes to prevent electrolysis.

2.5 COMMERCIAL TOILET ACCESSORIES

- A. Toilet Paper Dispenser (TTD): Double roll, surface mounted, for cored or coreless type rolls.
- B. Paper Towel Dispenser (PTD) : Manual, roll paper type.
- C. Combination Towel Dispenser/Waste Receptacle: Recessed flush with wall, stainless steel; seamless wall flanges, continuous piano hinges.
 - 1. Waste receptacle liner: Reusable, heavy-duty vinyl.
 - 2. Towel dispenser capacity: 400 C-fold.
 - 3. Waste receptacle capacity: 4 gallons (15 liters).
- D. Automated Soap Dispenser: Foam soap dispenser, deck-mounted on vanity, with container concealed below deck; chrome-plated brass with bright polished finish; chrome-plated deck escutcheon.
 - 1. Minimum Capacity: 27 ounces (0.80 liters).
 - 2. Power: Battery operated.

- E. Mirrors (M1 & M2): Stainless steel framed, 1/4 inch (6 mm) thick tempered safety glass; ASTM C1048.
 - 1. Annealed Float Glass: Silvering, protective and physical characteristics in compliance with ASTM C1503.
 - 2. Size:
 - a. M1: 24 inch by 36 inch.
 - b. M2: 24 inch by 48 inch.
 - 3. Frame: 0.05 inch (1.3 mm) angle shapes, with mitered and welded and ground corners, and tamperproof hanging system; satin finish.
 - 4. Backing: Full-mirror sized, minimum 0.03 inch (0.8 mm) galvanized steel sheet and nonabsorptive filler material.
 - 5. Fixed (Non-Tilt) Mirrors: Minimum 3 inches (75 mm) tilt from top to bottom.
- F. Grab Bars: Stainless steel, peened surface.
 - 1. Standard Duty Grab Bars:
 - a. Push/Pull Point Load: 250 pound-force (1112 N), minimum.
 - b. Dimensions: 1-1/2 inch (38 mm) outside diameter, minimum 0.05 inch (1.3 mm) wall thickness, concealed flange mounting, 1-1/2 inch (38 mm) clearance between wall and inside of grab bar.
 - c. Finish: Satin.
 - d. Length and Configuration: As indicated on drawings.
 - e. Products:
 - 1) Bobrick, B-6806 Series.
- G. Sanitary Napkin Disposal Unit (SND): Stainless steel, surface-mounted, self-closing door, locking bottom panel with full-length stainless steel piano-type hinge, removable receptacle.
- H. Robe Hook:
 - 1. At each toilet stall (on back of door) and individual toilet room (on back of wood door).
 - 2. Product: Bobrick B-212.

2.6 UNDER-LAVATORY PIPE AND SUPPLY COVERS

- A. Under-Lavatory Pipe and Supply Covers:
 - 1. Insulate exposed drainage piping, including hot, cold, and tempered water supplies under lavatories or sinks to comply with ADA Standards.
 - 2. Construction: 1/8 inch (3.2 mm) flexible PVC.
 - a. Surface Burning Characteristics: Flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
 - b. Comply with ASTM C1822, type indicated.
 - c. Comply with ASME A112.18.9.
 - d. Comply with ICC A117.1.
 - e. Microbial and Fungal Resistance: Comply with ASTM G21.
 - 3. Color: White.
 - 4. Products:
 - a. Plumberex Specialty Products, Inc; Plumberex Handy-Shield Maxx: www.plumberex.com/#sle.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.

2.7 DIAPER CHANGING STATIONS

- A. Diaper Changing Station: Wall-mounted folding diaper changing station for use in commercial toilet facilities, meeting or exceeding ASTM F2285.
 - 1. Material: Stainless steel.
 - 2. Mounting: Surface.
 - 3. Color: Gray.
 - 4. Minimum Rated Load: 250 pounds (113.4 kg).

- 5. Products:
 - a. Koala Kare Products, a division of Bobrick; Model KB310 SSWM.
 - b. Substitutions: Not permitted.

2.8 UTILITY ROOM ACCESSORIES

- A. Mop and Broom Holder: 0.05 inch (1.3 mm) thick stainless steel, Type 304, hat-shaped channel.
 - 1. Holders: Three spring-loaded rubber cam holders.
 - 2. Length: 36 inches (900 mm).
 - 3. Length: Manufacturer's standard length for number of holders.
 - 4. Products:
 - a. Bobrick, B-223 x 36.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify exact location of accessories for installation.
- C. Verify that field measurements are as indicated on drawings.

3.2 PREPARATION

- A. Deliver inserts and rough-in frames to site for timely installation.
- B. Provide templates and rough-in measurements as required.

3.3 INSTALLATION

- A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Inst
- B. Install plumb and level, securely and rigidly anchored to substrate.
- C. Grab Bars: Install to withstand a downward load of at least 250 lbf (1112N), when tested according to ASTM F446.
- D. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.
 - 1. Grab Bars: As indicated on drawings.
 - 2. Other Accessories: As indicated on drawings.

3.4 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items. Remove temporary labels and protective coatings. Clean and polish exposed surfaces according to manufacturer's written recommendations.

3.5 PROTECTION

- A. Protect installed accessories from damage due to subsequent construction operations.

END OF SECTION

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SECTION 10 44 00 - FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

- A. Fire extinguishers.
- B. Accessories.

1.3 REFERENCE STANDARDS

- A. FM (AG) - FM Approval Guide; Current Edition.
- B. NFPA 10 - Standard for Portable Fire Extinguishers; 2022.
- C. UL (DIR) - Online Certifications Directory; Current Edition.

1.4 REFERENCES

- A. Refer to specification Section 01 41 00 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 ACTION SUBMITTALS

- A. See Section 01 30 00 – Administrative Requirements and Section 01 60 00 – Product Requirements for submittal procedures.
- B. Product Data: Provide extinguisher operational features, extinguisher ratings and classifications, color and finish, anchorage details, and installation instructions.
- C. Shop Drawings: Indicate locations of cabinets, cabinet physical dimensions, rough-in measurements for recessed cabinets, locations of individual fire extinguishers, mounting measurements for wall bracket, installation procedures, and accessories required for complete installation.
- D. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- F. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers listed whose products meet or exceed the specifications are approved for use in the Work. Other manufacturers must have a minimum of five (5) years' experience manufacturing products meeting or exceeding the specifications and comply with Division 01 requirements regarding substitutions to be considered.
- B. Fire Extinguishers:
 - 1. Activar Construction Products Group, Inc. - JL Industries; Cosmic Extinguisher - Multipurpose Chemical: www.activarcpg.com/#sle.
 - 2. Kidde, a unit of United Technologies Corp: www.kidde.com/#sle.
 - 3. Oval Brand Fire Products; Oval Dry Chemical Fire Extinguisher - Multipurpose ABC: www.ovalfireproducts.com/#sle.
 - 4. Potter-Roemer: www.potterroemer.com/#sle.
 - 5. Substitutions: See Section 01 60 00 - Product Requirements for substitution procedures.

2.2 FIRE EXTINGUISHERS

- A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
- B. Water Type Fire Extinguishers: Stainless steel tank, pressurized, with premixed antifreeze solution, including hose and nozzle.
 - 1. Class: 2-A type.
 - 2. Size and classification as scheduled.
 - 3. Finish: Polished chrome.
 - 4. Temperature Range: Minus 40 degrees F (Minus 40 degrees C) to 120 degrees F (49 degrees C).
- C. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank
 - 1. Class: A:B:C type.
 - 2. Size and classification as scheduled.
 - 3. Finish: Polished chrome.
 - 4. Temperature range: Minus 40 degrees F (Minus 40 degrees C) to 120 degrees F (49 degrees C).

2.3 ACCESSORIES

- A. Extinguisher Brackets: Formed steel, chrome-plated.
- B. Lettering: "FIRE EXTINGUISHER" decal, or vinyl self-adhering, prespaced black lettering in accordance with authorities having jurisdiction (AHJ).

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions before starting work.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

END OF SECTION

SECTION 10 71 19.16 - REMOVABLE FLOOD BARRIERS

SUMMARY

1.1 WORK RESULTS:

- A. Installation of Removable Flood Barriers: Factory assembled aluminum flood log systems.

1.2 PRINCIPAL PRODUCTS:

- A. Gasketed Aluminum Flood Log System.

1.3 SECTION INCLUDES:

- A. Gasketed Aluminum Flood Logs.
- B. Aluminum Removable Jamb Support Brackets.
- C. Aluminum Mid-Span Posts.
- D. Fasteners.
- E. Accessories.

1.4 REFERENCE STANDARDS

- A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.
- B. ASCE/SEI 24 - Flood Resistant Design and Construction; 2024, with Errata (2025).
- C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
- D. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications; 2025a.
- E. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; Revision 21A, December 1, 2021.

1.5 ADMINISTRATIVE PROCEDURES

- A. Coordination Procedures: Coordinate flood barrier locations with existing architectural finishes.
- B. Preinstallation Meeting Attendees and Procedures:
 - 1. Conduct meeting one week, minimum before starting work in this Section.
 - 2. Additional Attendees: ???List Attendees???
 - 3. Additional Agenda Items:

1.6 ACTION SUBMITTALS

- A. Product Data: Provide manufacturer's information on each material and component of the flood barrier.
- B. Shop Drawings: Provide dimensioned plans, sections, connections, and anchorage details.
 - 1. Shop drawings to be signed and sealed by a professional engineer if required by the authorities having jurisdiction.
- C. Calculations: Provide calculations, signed and sealed by a qualified professional engineer licensed in the state or territory where the project is located, verifying the barrier's ability to withstand the design pressure loading, based on building code and specified load combinations.

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Statements: For the manufacturer, installer, and/or professional engineer.
- B. Delegated Design Submittals: Design for installation system, including supports and anchorage to substrate.
- C. Test and Evaluation Reports: Manufacturer test results showing resistance to flood water pressures.
- D. Manufacturer's instructions.

E. FEMA Submittals:

1. Dry Floodproofing Certificate for Non-Residential Structures, latest edition.
2. Flood Emergency Operation Plan per FEMA TB 3, latest edition.
3. Inspection and Maintenance Plan per FEMA TB 3, latest edition.
4. Flood Insurance: Documentation that design factored in estimated flood insurance costs for the building per FEMA TB 3, latest edition.
5. Proof of Annual Service Agreement, as required by the authorities having jurisdiction.
6. Proof of Early Warning System, as required by the authorities having jurisdiction.
7. Dry Floodproofing Credit for NFIP Flood Insurance: The above documents should get submitted to apply for a Dry Floodproofing Credit (only available for non-residential buildings). Contact an Insurance Agent for assistance in submitting and for more information.

1.8 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Manual.
- B. Warranty Documentation.

1.9 QUALITY ASSURANCE

- A. Qualifications:
 1. Manufacturer: Five (5) years of documented experience, minimum, in the manufacture of the products specified in this Section.
 2. Installer: Three (3) years of experience, minimum, in the installation of the products specified in this Section.
 3. Licensed Professional Engineer: A professional engineer specialized in the work specified in this Section and licensed in the State in which the project is located.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products in manufacturer's unopened packaging with labels undamaged, legible, and readable until ready for installation. Inspect materials for damages.
- B. Protect stored materials from moisture exposure.
- C. Store materials in a dry, cool, ventilated, and weathertight location.
- D. Outdoor Storage Requirements (if necessary): Store materials on an incline to avoid moisture accumulation and facilitate runoff. Cover materials with a tarp set up in a tent-like fashion and raised above the products to allow for air circulation and to avoid UV exposure. Keep all additional hardware in a dry, climate-controlled setting.

1.11 FIELD CONDITIONS

- A. Ambient Conditions: Perform work within manufacturer's recommended weather and temperature limitations.
- B. Existing Conditions: Verify field measurements before fabrication. Show field measurements on Shop Drawings.
 1. Have flood barrier manufacturer, installer, or qualified person(s) conduct site survey to document the conditions at the installation site to detail the type of materials, dimensions, configuration, potential interferences with the mounting surface, and any other contributing factors for proper installation.

1.12 WARRANTY

- A. Manufacturer Warranty:
 1. Warrant product to be free from defects in material and workmanship for a period of one (1) year from date of shipment.
 2. Contact manufacturer regarding extended warranty options.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. Approved Manufacturer: Floodproofing.com, Inc., which is located at 19 Mantua Road, Mount Royal, NJ, 08061; Telephone: 800-507-0865; Email: info@floodproofing.com; Website: www.floodproofing.com.
 - 1. Basis of Design Product: Flood Panel Mega Flood Log System by Floodproofing.com.
- B. Substitutions: Not permitted.
- C. Single Source Responsibilities: Obtain all flood log system assemblies from single manufacturer.

2.2 MATERIALS

- A. Flood Logs: ASTM B209/B209M, Alloy 6005A-T61.
- B. Intermediate or End Posts:
 - 1. ASTM B209/B209M, Alloy 6005A-T61.
 - 2. Painted Steel: Grade ST37 (S235 JR).
 - 3. Galvanized Steel.
 - 4. Below Ground Supports: Galvanized Steel.
 - 5. Permanent end posts available with optional primed covers.
- C. Mid-Span and Corner Supports:
 - 1. ASTM B209/B209M, Alloy 6005A-T61.
 - 2. Painted Steel: Grade ST37 (S235 JR).
 - 3. Galvanized Steel.
- D. Base Gaskets: Sandwich composite combination low/high compressed gaskets mechanically retained in the flood logs; 40D medium compression set gaskets retained mechanically in the top of each log and low compression gaskets in the jambs and mid-span supports.
- E. Wall Plates (if required):
 - 1. Primed Steel: Grade ST37 (S235 JR).
 - 2. 316 Stainless Steel.
- F. Primer on Steel Products: Rust inhibitive and lead free.
 - 1. Manufacturers and Products:
 - a. TCI SD RAL 7035 Light Grey 25#
 - b. Or approved equal.
- G. Joint Sealant:
 - 1. Manufacturers and Products:
 - a. 3M; 4000 Sealant.
 - b. Or approved equal.

2.3 PERFORMANCE REQUIREMENTS

- A. Engineering Code Practices: Engineer flood products to conform to the design requirements that are based on the latest adopted editions of ASCE 24, ASCE 7, and the International Building Code (IBC).
- B. Design Criteria: Conform to the requirements for A and AE Zones as set forth by the National Flood Insurance Program (NFIP).
 - 1. Design flood logs to support, either individually or in combination, temporary superimposed live loads as specified in the latest editions of ASCE 24 and ASCE 7.
 - 2. Ensure all types of flood-related loads from the flood protection barriers are transferred either through mullion anchorage to structural floor slabs and/or jamb anchorage, and directly via pressure contact with structural walls or other structural elements.

3. Per ASCE 24, the flood logs and all necessary accessories for the flood logs shall be tested to and certified to meet the applicable requirements of the American National Standard for Flood Mitigation Equipment, ANSI/FM 2510.
- C. Product Criteria:
1. Flood Log Overview: 12-inch-high x 3-inch-deep with a top interlocking gasket slot system which includes gaskets and gasket channels between sections and full height in the jamb channels. The bottom flood log includes an additional bottom gasket for compression at the ground. For flood protection heights in between 12-inch increments, there is a 6-inch-high x 3-inch-deep flood log topper available to be placed as the top log in the stacked configuration.
 - a. Stack multiple logs to meet or exceed base flood elevation plus 12 or more inches for wave action and freeboard requirements.
 - b. Embed wall plates may be required at jambs based on the condition at the opening and the loads imposed on the system.
 - c. Jamb supports to be continuous structural aluminum or steel channels and are to be anchored and sealed to the condition with embeds or mechanical anchors.
 - d. Frames and posts to provide mounting holes for connecting anchors and bolts. Anchor type, size, and method dependent on load capabilities of the structure.
 2. Flood Log Testing: The Flood Panel Mega Flood Log Systems, by Floodproofing.com, have passed and are compliant with the requirements of American National Standard for Flood Mitigation Equipment, ANSI/FM 2510 Standards, Section 4.3 Performance Testing – Flood Barriers for Opening Barrier Applications.
 - a. Leakage: Product configurations were tested and certified at various hydrostatic head levels and passed the max leakage rate in the ANSI/FM 2510 standard of .08 gallons per hour per linear feet of gasket seal, with a rate of .01 gallons per hour per linear feet of gasket seal.
 - b. Impact: Product configurations were tested, certified, and passed the impact requirements in ANSI/FM 2510 of 110 lbs. log with a 15 degree off center angle cut impact.
- D. Deployment:
1. For standard systems, full-height deployment is required to achieve vertical compression.
 2. For incremental deployment above 18 inches in height, custom Removable Jamb Support Brackets and Mid-Span Posts would be required to include additional vertical compression slots. This request needs to be relayed to the manufacturer for quoting and design purposes.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Verify that substrates are as required by the manufacturer.
 1. Verify that substrate surfaces against which the sealing gasket presses are “paper-smooth.”
 - a. If substrate surface is not smooth, wall plates may be required.
 2. Verify that substrates are plumb, square, and level before installation can begin.
- B. Notify Architect if substrates are damaged or deficient per manufacturer’s requirements.
- C. Begin installation once damaged or deficient substrates have been repaired to the manufacturer’s satisfaction.

3.2 PREPARATION

- A. Existing slabs, walls, and columns adjacent to openings where flood barriers are to be installed shall be structural for loading requirements and waterproofed with a waterproof membrane or a waterproof sealer surface treatment prior to the installation of flood barriers.

3.3 INSTALLATION

- A. Consult with manufacturer regarding installation costs and service options or self-install.
- B. Install flood barriers in accordance with manufacturer's instructions and approved shop drawings.
- C. Install embed plates using an immersible sealant or waterproof grout at back of support covering full height and width of support and producing squeeze out on all sides assuring a proper seal.
- D. Provide bituminous paint between finished aluminum supports and concrete or masonry and dissimilar metals.
- E. Install supports true and plumb without racking or warping.

3.4 FIELD QUALITY CONTROL

- A. Field Tests and Inspections: Installer to perform visual dry test for gasket alignment, continuity contact and pre-compression.

3.5 CLEANING AND STORAGE

- A. Inspect components for damages.
- B. Touch-up minor damages to components to the satisfaction of the Architect. Replace components that are beyond repair.
- C. Clean exposed surfaces and let dry before storing.
- D. Consult with manufacturer on options for storage racks, storage shelving systems, and deployment storage carts.

3.6 PROTECTION

- A. Locate dismantled barriers to a storage location designated by the Owner.
 - 1. Stack barriers in a manner that does not damage the gaskets.
 - 2. Position gaskets away from high traffic areas in the storage area to prevent damage.
- B. Protect installed product and finished surfaces during normal and general operation.

END OF SECTION

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SECTION 114000 - FOOD SERVICE EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The general provisions of the contract including general and supplementary conditions and general requirements apply to the work specified in this section.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Plumbing: Refer to Division 22, including:
 - 1. Rough-in piping for gas and water supply and waste lines.
 - 2. Piping for supply and waste lines.
 - 3. Traps, grease traps, line strainers, tail pieces, valves, stops, shut offs and miscellaneous fittings required for complete installation.
 - 4. Final connections.
 - 5. Indirect drains for sink compartments.
- B. Mechanical: Refer to Division 23, including:
 - 1. Roof mounted fans and connecting ductwork not shown as part of the kitchen equipment.
 - 2. Final connections, including approved welded duct connections to hoods.
- C. Electrical: Refer to Division 26, including:
 - 1. Rough-in conduit, wiring, line and disconnect switches, safety cut-offs and fittings, control panels, fuses, boxes, and fittings required for complete installation.
 - 2. Final connections, including mounting and wiring of switches furnished as part of the food service equipment (unless otherwise indicated on the drawings).

1.3 WORK INCLUDED THIS SECTION:

- A. Furnish and install all food service equipment as specified herein, including that which is reasonably inferred, with all related items necessary to complete work shown on contract drawings and/or required by these specifications.
- B. Electrical Work:
 - 1. Interwiring of food service equipment between components within equipment, such as heating elements, switches, thermostats, motors, etc., complete with junction box as is applicable, ready for final connection.
 - 2. Voltages shall be as indicated on contract drawings. Any differences in electrical characteristics at job site from those shown on contract documents must be submitted to Architect for consideration prior to ordering equipment.
- C. Plumbing Work:
 - 1. Furnish all equipment with faucets, sink waste assemblies, and trim as specified in this section.
 - 2. Other than sink compartments, extend all indirect waste lines to nearest floor receptor. All such drain lines to be properly sized. Drain shall terminate with proper air gap above flood rim of floor receptor. Drain lines to be copper with silver paint unless specified otherwise. Drain lines in public areas to be chrome plated where exposed to public view.

1.4 QUALITY ASSURANCE

- A. It is required that all custom fabricated equipment such as food serving units, tables, sinks, counter tops, etc., be manufactured by a food service equipment fabricator who has the plant, personnel and engineering equipment required. Such manufacturer shall be subject to approval of Architect. All work in above category shall be manufactured by one manufacturer and shall be of uniform design and finish.
- B. Manufacturer of this equipment must be able to show that they are now and for the past five years have been engaged in manufacture or distribution of equipment, as required under this contract, as their principal product.
- C. Manufacturer of equipment herein specified shall be a recognized distributor for items of equipment specified herein which are of other manufacture than their own.
- D. Only manufacturers who can meet the foregoing qualifications will be acceptable.
- E. All work shall be done in an approved professional manner, to the complete satisfaction of the Owner.

1.5 SUBMITTALS

- A. Submit shop drawings as required by General Conditions. All shop drawings and rough-in drawings shall be CAD drafted and must be submitted in .DWF or .PDF electronic format. Multiple hard copies are not acceptable.
- B. Shop drawings and bound brochures covering manufactured or "buy-out" items covering all work and equipment included in this contract shall be submitted to Architect as soon as possible after award of contract. After approval, Food Service Equipment Contractor shall furnish to Architect electronic files of shop drawings and brochures, corrected as required by virtue of review comments, for distribution to various interested trades on project. All costs of reproduction and submission shall be part of the contract.
Bound brochures and cut sheet submittals must be copied to the Owner for review and comment.
- C. Provide fully dimensioned rough-in plans at 1/4" scale, consisting of a separate drawing for each discipline. Each drawing shall show equipment shaded down 50%. Rough-in set shall include all required mechanical, electrical, plumbing, services for equipment and dimensioned rough-in location for same. Rough-in locations shown shall make allowances for required traps, switches, etc., thereby not requiring interpretation or adjustment on the part of other Contractors.
Food Service Equipment Contractor shall visit site to verify all rough-in and sleeve locations prior to installation of finished floors and shall cooperate with other Contractors involved in proper location of same. Food Service Equipment Contractor shall be responsible for any required relocations of rough-in due to errors or inaccuracies on those rough-in plans which they prepare.
- D. Rough-in plans shall include all required services which relate to equipment, but which may not directly connect thereto, such as convenience outlets at walls, hose stations, floor drains, etc.
- E. Rough-in plans shall also include all required outlet services for equipment which is designated on drawing schedule, even though such equipment may not be included in this contract. Drawings shall indicate dimensions for floor depressions, wall openings, etc., for equipment.
- F. Fully dimensioned and detailed shop drawings of custom fabricated equipment items shall be submitted, drawn at 3/4" and 1-1/2" scale for plans, elevations, and sections respectively.
Drawings shall show all details of construction, installation, and relation to adjoining and related work where cutting or close fitting is required. Drawings shall show all reinforcements, anchorage, and other work required for complete installation of all fixtures.

- G. Do not begin fabrication of custom manufactured equipment until approvals of shop drawings have been received and until field measurements have been taken by Food Service Equipment Contractor, where such measurements are necessary to assure proper conformance with intent of contract drawings and specifications.
- H. Make field measurements, giving due consideration to any architectural, mechanical, or structural discrepancies which may occur during construction of building. No extra compensation will be allowed for any difference between actual measurements secured at job site and dimensions indicated on contract drawings. Any differences which may be found at job site during field measurements shall be submitted to Architect for consideration before proceeding with fabrication of equipment.
- I. Submit illustrative brochures for manufactured or "buy-out" equipment items, complete with illustrations, specifications, line drawings, rough-in requirements, and list of accessories or other specified additional requirements. Brochures shall be bound and shall include data on all equipment which is to be provided, arranged in numerical sequence which conforms to item numbers of specifications. Omission of data does not reduce obligation to provide items as specified.
- J. Approval of shop schedules and brochures will be in general and shall be understood to mean that Architect has no objection to use of materials or processes shown. Approval does not relieve Food Service Equipment Contractor from responsibility for errors, omissions, or deviations from their contract requirements.

1.6 SUBSTITUTIONS - STANDARDS

- A. Refer to Instructions to Bidders and Division 01 for requirements.
- B. All unspecified substitutions after bid must be submitted to Owner for written approval prior to acceptance.

1.7 DRAWINGS

- A. Drawings which constitute part of contract documents indicate general arrangement of piping and location of equipment. Should it be necessary to deviate from the arrangement indicated to meet structural conditions, make such deviations without expense to Owner.
- B. Specifications and drawings are reasonably exact, but their extreme accuracy is not guaranteed. Drawings and specifications are for assistance and guidance of Contractor, and exact locations, distances and levels shall be governed by the building.

1.8 MANUFACTURER'S DIRECTIONS

- A. Follow manufacturer's directions in all cases where manufacturers of articles used in this contract furnish directions or prints covering points not shown on drawings or specifications.

1.9 INDUSTRY STANDARDS

- A. Electric operated and/or heated equipment, fabricated or otherwise, shall conform to the latest standards of National Electric Manufacturers Association and of Underwriters Laboratories, Inc., and shall bear the U.L. label.
- B. Cooking and hot food holding equipment shall meet minimum construction standards as noted by NSF #4.
- C. Refrigeration equipment shall meet minimum construction standards as noted by NSF #7.

- D. Items of food service equipment furnished shall bear the N.S.F. seal.
- E. Food service equipment shall be installed in accord with N.S.F. standards.
- F. Work and materials shall comply with requirements of applicable codes, ordinances, and regulations, including but not limited to those of Occupational Safety and Health Act (OSHA), National Fire Protection Association, State Fire Marshal, State Accident Commission, U.S. Public Health Service, State Board of Health, local health codes, etc.
- G. No extra charge will be paid for furnishing items required by regulations, even though such may not be shown on drawings or called for in these specifications.
- H. Rulings and interpretations of enforcing agencies shall be considered part of regulations.

PART 2 - PRODUCTS

2.1 MANUFACTURED EQUIPMENT

- A. All like types of equipment such as all refrigerated and heated cabinets, all ovens, and all mixers shall be by the same manufacturer.
- B. Except as may be specified otherwise under individual item specifications in "Equipment Schedule", all items of standard manufactured equipment shall be complete in accord with manufacturer's standard specification for specific unit or model called for, including finishes, components, attachments, appurtenances, etc., except as follows:

All items of standard equipment shall be that manufacturer's latest model at time of delivery. Substitutions for manufactured equipment specified will be accorded consideration under terms set forth in "Substitutions - Standards".

2.2 FABRICATED EQUIPMENT

- A. Stainless steel shall be U.S. standard gauges as called for, 18-8, Type 302, Type 304 or No. 4 finish.
- B. Galvanized iron shall be Armco or equal. Framework of galvanized iron shall be welded construction, having welds smooth, and where galvanizing has been burned off, touched up with high grade aluminum bronze.
- C. Legs and crossrails shall be continuously welded, unless otherwise noted, and ground smooth.
- D. Bottom of legs at floor shall be fitted with sanitary stainless-steel bullet type foot, with not less than 2" adjustment.
- E. Legs shall be fastened to equipment as follows:
 - 1. To sinks by means of closed gussets. Gussets shall be stainless steel, reinforced with bushing, having set screws for securing legs.
 - 2. To tables and drainboards with closed gussets which shall be welded to stainless steel hat sections or channels, 14 gauge or heavier, exposed hat sections having closed ends. Bracing shall be welded to the underside of tops.
- F. Closed gussets shall be a 3" minimum diameter at top, continuously welded to frame members or to sink bottom.

- G. Sinks, unless otherwise specified, shall be furnished with rotary type waste outlets, without connected overflows: Atlantic Brass Works Model 772-RB; Fisher Brass Foundry Model 250A; T&S; or approved equal. Where exposed, furnish wastes chromium plated.
- H. Rolls shall be 1 1/2" diameter, except as detailed contrary, with corners bullnosed, ground and polished.
- I. Seams and joints shall be shop welded. Welds to be ground smooth and polished to match original finish. Materials 18 gauge or heavier shall be welded.
- J. Metal tops shall be one-piece welded construction, unless specified otherwise, reinforced on underside with stainless steel hat sections or channels welded in place. Crossbracing to be not more than 30" on centers.
- K. Drawers to be 18-gauge stainless steel channel type housing and drawer cradle, both housing and cradle being reinforced and welded at corners, housing being secured to underside of table top, and both housing and cradle being sized for and fitted with 18-gauge 20" x 20" x 5" deep stainless- steel drawer insert having coved corners. Drawer insert shall be easily removable from cradle without tools or having to remove entire drawer. Drawers to have stainless steel fronts. Provide with recessed flush type stainless steel pulls.
- L. Fabricate sink compartments with fully coved vertical and horizontal corners. Multiple compartment partition to be double thickness, continuously welded where sheets join at top. Front of multiple compartment sinks to be continuous on exterior. Bottoms shall be creased to drain.
- M. Ends of all fixtures, splashbacks, shelves, etc., shall be finished flush to walls or adjoining fixtures.
- N. Dishtables, draitables, splashbacks and turned-up edges shall have radius bends in all horizontal and vertical corners, coved at intersections.
- O. Rounded and coved corners or radius bends shall be 1/2" radius or longer.
- P. Shelves in fixtures with enclosed bases shall be turned up on back and sides and feathered slightly to ensure tight fit to enclosure panels. Bottom shelves shall be made for easy removal unless otherwise noted.
- Q. Undersides of tops to be coated with heavy-bodied resinous material compounded for permanent, non-flaking adhesion to metal, 1/8" thick, applied after reinforcing members have been installed, drying without dirt-catching crevices.
- R. Metal components, unless specified or noted otherwise, to be the following gauges:

Counter and table tops	14 ga.	Stainless Steel
Wall shelves	16 ga.	Stainless Steel
Pipe leg undershelves	16 ga.	Stainless Steel
Drawer fronts	16 ga.	Stainless Steel
Sinks and drainboards	14 ga.	Stainless Steel
Legs 1 - 5/8" diameter	16 ga.	Stainless Steel
Doors (outer pan)	18 ga.	Stainless Steel
Doors (inner pan)	20 ga.	Stainless Steel

- S. Products fabricated by Savannah Industrial Solutions, John Boos, Premier Stainless, Eagle Group, Advance Tabco, or approved equal, modified to comply with specifications, are acceptable.

2.3 HEATING EQUIPMENT

- A. Wherever electric heating equipment or thermostat control for such equipment is specified, it shall be complete, and of the materials, size and rating specified within equipment item or details.

All such equipment shall be designed and installed to be easily cleaned or to be easily removed for cleaning.

- B. Electrical appliances or heating element circuits of 120 volts shall not exceed 1650 watts, unless specifically shown contrary.

2.4 SWITCHES AND CONTROLS

- A. Food Service Equipment Contractor shall supply on each motor driven appliance or electrical heating unit suitable control switch of proper type in accord with Underwriter's Code.
- B. All internal wiring for fabricated equipment items included, all electrical devices, wiring, controls, switches, etc., built into or forming an integral part of these items shall be furnished and installed by Food Service Equipment Contractor in their factory or building site with all items complete to junction box for final connection to building lines by Electrical Contractor.
- C. Provide standard 3-prong plugs to fit "U" slot grounding type receptacles, similar to No. 5262, for all equipment items powered by plugging into 110-120 volts, single phase AC. Also, provide suitable length 3-wire cord for equipment.

2.5 CONNECTION TERMINALS

- A. All equipment shall be complete with connection terminals as standardized by equipment manufacturers, except where specified otherwise.

2.6 LOCKS

- A. Fit all doors for reach-in refrigerated compartments with locking type latches. Provide master keys.

PART 3 - EXECUTION

3.1 GENERAL

- A. Work under this contract and covered under this section of specifications includes but is not limited to:
 - 1. Cutting of holes and/or ferrules on equipment for piping, drains, electrical outlets, conduits, etc. as required to coordinate installation of food service equipment with work of other Contractors on project.
 - 2. Field checking of building and rough-in requirements, and submission of brochures and shop drawings, all as required hereinbefore under "Submittals".
 - 3. Repair of all damage to premises as result of this installation, and removal of all debris left by those engaged in this installation.
 - 4. Having all food service equipment fixtures completely cleaned and ready for operation when building is turned over to Owner.

3.2 INSTALLATION PROCEDURES

- A. Food Service Equipment Contractor shall make the arrangements for receiving their custom fabricated and "buy out" equipment and shall make delivery into building as requisitioned by their installation superintendent. They shall not consign any of their equipment to Owner or to any other Contractor unless they have written acceptance from them and have made satisfactory arrangements for the payment of all freight and handling charges.

- B. Food Service Equipment Contractor shall deliver all their custom fabricated and "buy out" equipment temporarily in its final location, permitting Trades to make necessary arrangements for connection of service lines; they shall then move equipment sufficiently to permit installation of service lines, after which they shall realign their equipment level and plumb, making final erection as shown on contract drawings.
- C. All portable or counter mounted equipment weighing more than 25 pounds shall be mounted on 4" stainless steel adjustable legs.
- D. This Contractor shall coordinate their work and cooperate with other trades working at site toward the orderly progress of the project.
- E. Architect or Owner's Agent shall always have access to plant or shop in which custom fabricated equipment is being manufactured, from time contract is let until equipment is shipped, in order that progress of work can be checked, as well as any technical problem which may arise in coordination of equipment with building. Any approval given at this point of manufacture shall be tentative, subject to final inspection and test after complete installation.
- F. Food Service Equipment Contractor shall assist Architect, Owner, and/or Owner's Agent in making any desired tests during or prior to final inspection of equipment; they shall remove immediately any work or equipment rejected by Architect, Owner, and/or Owner's Agent, replacing same with work conforming with contract requirements, and shall reimburse mechanical and/or other contractors involved for extra work made necessary by such replacement.
- G. This Contractor shall keep premises free from accumulation of their waste material and rubbish, and at completion of their work shall remove their rubbish and implements, leaving areas of their work broom clean.
- H. This Contractor shall provide and maintain coverings or other approved protection for finished surfaces and other parts of their equipment subject to damage during and after erection. After removal of protective coverings, all field joints shall be grounded, polished and entire work shall be thoroughly cleaned and polished.

3.3 TRIMMING AND SEALING EQUIPMENT

- A. Seal completely spaces between all units to walls, ceilings, floors, and adjoining (not portable) units with enclosed bodies against entrance of food particles or vermin by means of trim strips, welding, soldering, or commercial joint material best suited to nature of equipment and adjoining surface material.
- B. Close ends of all hollow sections.
- C. Equipment butting against walls, ceilings, floor surfaces and corners to fit tightly against same; backsplashes or risers which fit against wall to be neatly scribed and sealed to wall with Dow Corning # 732 RTV or General Electric clear silicone sealant, wiping excess sealant out of joint to fillet radius. Where required to prevent shifting of equipment and breaking wall seal, anchor item to floor or wall.
- D. Treat enclosed spaces (inaccessible after equipment installation) for vermin prevention in accord with industry practice.

3.4 TESTING AND DEMONSTRATION OF EQUIPMENT

- A. After completion of installation, all equipment using water, gas, and electricity shall be performance inspected and tested by a factory certified service agent, including wet test of hood fire suppression systems, if so required. Food Service Equipment Contractor shall document that these inspections have been performed prior to scheduling demonstrations and Owner acceptance of equipment.

- B. Food Service Equipment Contractor shall arrange to have all manufactured, mechanically operated equipment furnished under this contract demonstrated by authorized representatives of equipment manufacturers, these representatives to instruct Owner's designated personnel in use, care, and maintenance of all items of equipment after same are in working order. Demonstration and instruction shall be held on dates designated by Owner.
- C. Food Service Equipment Contractor shall provide a competent service representative to be present when installation is put into operation.

3.5 EQUIPMENT HANDLING AND STORAGE

- A. Deliver equipment to site, properly crated and protected and store in safe place, protected from damage until time for installation.

3.6 GUARANTEE

- A. Special Project Warranty: Provide written warranty, signed by manufacturer, agreeing to replace/repair, within warranty period, with inadequate and defective materials and workmanship, including leakage, breakage, improper assembly, or failure to perform as required, provided manufacturer's instructions for handling, installing, protecting, and maintaining units have been adhered to during warranty period. This warranty shall be in addition to, and not limitation of, the rights the Owner may have against the Contractor under the Contract Documents.
- B. Warranty Period:
1 year minimum from date of Substantial Completion, all new equipment furnished.
5-year warranty period on refrigeration compressors.

3.7 OPERATING AND MAINTENANCE MANUALS

- A. After completion of installation, Food Service Equipment Contractor shall present to Owner three sets of all operating and maintenance manuals, covering all mechanically operated equipment furnished under this contract, each set being neatly bound in loose-leaf binder having durable cover.
- B. Include in each binder a list of names, addresses and telephone numbers of local servicing agencies authorized to make necessary repairs and/or adjustments of equipment furnished under this contract.

PART 4 – EQUIPMENT SCHEDULE

ITEM 01 THREE (3) COMPARTMENT SINK QUANTITY AS SCHEDULED

Provide three compartment sink with the following features:

- A. 3-Compartment
 - B. 105-1/4"W x 29-1/2"D
 - C. (3) 18"W x 24" front-to-back x 14" deep compartments, (3) lever wastes
 - D. (2) 24" Left & right drainboards
 - E. 10"H boxed backsplash with 45° top and 2" return
 - F. (1) Set of splash mount faucet holes with 8" centers
 - G. 14/300 Stainless steel construction, legs, adjustable front & side bracing, adjustable bullet feet
 - H. Pre-rinse unit, with 16" swing add-in faucet
- Three compartment sink to be as manufactured by John Boos, Model No. 43PB18244-2D24, Eagle Group, or Premier Stainless.

ITEM 02A POT RACK QUANTITY AS SCHEDULED

Provide wall mount pot rack with the following features:

- A. 36"W x 12"D X 2"H
- B. 3/16" x 2" Stainless steel flat bar
- C. Wall mounted, 6' A.F.F.
- D. Includes (3) stainless steel double hooks

Rack to be as manufactured by John Boos, Model No. PRW11A, Eagle Group, or Premier Stainless.

ITEM 02B DISHTABLE SORTING SHELF

QUANTITY AS SCHEDULED

Provide wall mount sorting shelf with the following features:

- A. 42"W x 15-3/8"D X 16-1/2"H
- B. Holds (2) racks
- C. Wall mounted, 5'-4" A.F.F.
- D. Solid, 18/300 stainless steel
- E. Includes brackets
- F. Drain tube on left

Shelf to be as manufactured by John Boos, Model No. PB-SRW-42, Eagle Group, or Premier Stainless.

ITEM 03 DISHWASHER, UNDERCOUNTER

QUANTITY AS SCHEDULED

Provide dishwasher with the following features:

- A. Undercounter
- B. 22 11/16"W x 24"D x 32 5/16"H
- C. High temperature sanitizing
- D. (24) Racks/hr., .84 Gal/rack
- E. Fresh water rinse
- F. Delime notification and cycle
- G. Service diagnostics with error notifications
- H. Soft start
- I. Detergent & rinse aid pumps
- J. Drain water tempering kit, installation kit
- K. Voltage as scheduled, cord and plug

Dishwasher to be as manufactured by Hobart, Model No. CUH-1, CMA Dishmachines, or Champion.

ITEM 04 SHELVING UNIT

QUANTITY AS SCHEDULED

Provide wire shelving unit with the following features:

- A. 48"W x 21"D x 67-5/16"H
- B. (4) Open grid shelves with epoxy coated steel frames & removable polymer shelf mats
- C. (4) Polymer posts
- D. Antimicrobial product protection
- E. (4) Swivel 5" casters with polyurethane treads (2 braked)

Shelving unit to be as manufactured by Metro, Model No. Q456EG3, Quantum, or Cambro.

ITEM 05

NOT USED

ITEM 06 HAND SINK

QUANTITY AS SCHEDULED

Provide wall mount hand sink with the following features:

- A. 13-1/2" Wide x 9-3/4" front-to-back x 6-3/4" deep bowl
- B. 304 Stainless steel construction
- C. Splash mount gooseneck faucet
- D. Basket drain
- E. Deep-drawn seamless design-positive drain
- F. Inverted "V" edge
- G. Side splash where required

Hand sink to be as manufactured by Eagle Group, Model HSA-10-F, Premier Stainless, or John Boos.

ITEM 07 WORK TABLE, S/S TOP QUANTITY AS SCHEDULED

Provide work table having the following features:

- A. 60"W x 30"D
- B. 14/300 Series stainless steel top
- C. Locking gusset system
- D. Stainless steel crossrails on side & rear
- E. (4) Stainless steel legs, stainless steel bullet feet
- F. Weld-in sink bowl, 16"x20"x14" on left
- G. Splash mount faucet, 8" spout, lever drain

Worktable is to be manufactured by Eagle Group, Model T3060STE-BS-MOD, Premier Stainless, or John Boos.

ITEM 08 COMBI OVEN, ELECTRIC QUANTITY AS SCHEDULED

Provide combi oven with the following features:

- A. Electric
- B. Countertop, with ventless hood
- C. (5) 12" x 20" full size hotel or (10) 18" x 13" half size sheet pan capacity
- D. Touch control includes two-speed reversing fan
- E. Retherm mode
- F. Moisture injection
- G. 6 Browning levels, reduced energy levels
- H. Steam venting
- I. Shelf timer and USB port
- J. Includes: system & hand sprayer kit
- K. (2) Shelves
- L. Stainless steel construction
- M. Adjustable bullet legs
- N. Combi Oven stand, stationary with lower shelf
- O. Doors hinged right
- P. Water filter
- Q. Back flow preventor
- R. Voltage as scheduled, direct connection

Combi oven to be as manufactured by Alto-Shaam, Model No. CTX4-10EVH, Unox, or Cleveland.

ITEM 09 MOBILE HEATED CABINET QUANTITY AS SCHEDULED

Provide mobile heating and proofing cabinet having the following features:

- A. Mobile
- B. 3/4 Height
- C. Non-insulated
- D. Clear polycarbonate door
- E. Removable bottom mount control module
- F. Fixed wire slides on 3" centers (14) 18" x 26" or (26) 12" x 20" x 2-1/2" pan capacity
- G. 5" Casters (2 with brakes)
- H. Aluminum construction
- I. Voltage as scheduled, cord and plug

Mobile heated cabinet to be as manufactured by Metro, Model C517-CFC-4, Alto-Shaam, or Cres Cor.

ITEM 10 NOT USED

ITEM 11 REACH-IN REFRIGERATOR QUANTITY AS SCHEDULED

Provide reach-in refrigerator with the following features:

- A. Two-section
- B. (2) Solid doors
- C. (6) PVC coated adjustable wire shelves

- D. Interior lighting
 - E. Stainless steel doors, left hinged on left and right hinged on right
 - F. Stainless steel front
 - G. Aluminum sides
 - H. Aluminum interior with stainless steel floor
 - I. 4" Casters
 - J. R290 Hydrocarbon refrigerant
 - K. 1/2 HP
 - L. Voltage as scheduled, cord and plug
- Refrigerator to be as manufactured by True, Model, T-49-HC, Continental, or Beverage Air.

ITEM 12 ICE MAKER WITH BIN, CUBE STYLE QUANTITY AS SCHEDULED

Provide undercounter ice maker with the following features:

- A. Air-cooled
 - B. Self-contained condenser
 - C. Nom. 30"W x 28"D x 38"H
 - D. Production capacity up to 286 lbs./24 hours at 70°/50° (233 lb. AHRI certified at 90°/70°)
 - E. 119 lb. Ice storage capacity
 - F. Full bin and service indicators
 - G. Production delay (4, 12, or 24 hours)
 - H. Water filter assembly
 - I. Anti-microbial protection
 - J. Forward sliding storage bin
 - K. Distribution tube and damper door
 - L. Sealed food zone with removable water trough
 - M. 6" Adjustable legs with flanged feet
 - N. Dice size cubes
 - O. Backflow prevention device
 - P. Voltage as scheduled, cord and plug
- Ice maker to be as manufactured by Manitowoc, Model No. UDF0310A, Ice-O-Matic, or Scotsman.

ITEM 13 NOT USED

ITEM 14 POPCORN POPPER QUANTITY AS SCHEDULED

Provide mobile heated cabinet with the following features:

- A. Electric
 - B. Countertop
 - C. 12/14 oz. S/S kettle
 - D. Voltage as scheduled, cord and plug
 - E. Heated corn deck
 - F. Filter system with (2) exhaust blowers
 - G. Tempered glass
 - H. Clear plastic doors
 - I. S/S Cabinet and done
 - J. Voltage as scheduled, cord and plug
- Mobile heated cabinet to be as manufactured by Gold Metal Production, Model No. 2552, Winco, or Admiral Craft.

ITEM 15 NOT USED

ITEM 16 COFFEE TEA BREWER N.I.K.C.

This item is to be furnished by Vendor.

ITEM 17 WORKTOP FREEZER QUANTITY AS SCHEDULED

Provide spec series worktop freezer having the following features:

- A. Two-section
- B. Stainless steel top with rear splash
- C. (2) Stainless steel doors, steel handles
- D. Door lock
- E. (4) PVC Coated adjustable wire shelves
- F. Stainless steel front & sides, aluminum interior with stainless steel floor
- G. Electronic temperature control with digital temperature display
- H. Stainless steel construction
- I. Rear mounted self-contained refrigeration, R290 Hydrocarbon refrigerant
- J. Low-profile casters
- K. Voltage as scheduled, cord and plug

Worktop freezer to be as manufactured by True, Model TWT-48F-HC~SPEC3, Continental, or Beverage-Air.

ITEM 18 MICROWAVE OVEN

QUANTITY AS SCHEDULED

Provide microwave oven with the following features:

- A. Heavy duty
- B. 1800 Watts
- C. 1.2 Cubic feet
- D. Nom. 22"W x 20"D x 14"H
- E. Side hinged door with glass window
- F. (10) Menu pads with capacity to program (100) menus
- G. (5) Power levels
- H. 3-Stage cooking
- I. Interior oven light
- J. Dual magnetrons
- K. Stainless steel construction
- L. Voltage as scheduled, cord and plug

Microwave oven to be as manufactured by Waring, Model No. WMO120, Panasonic, or Sharp.

ITEM 19 UTILITY CART

QUANTITY AS SCHEDULED

Provide utility cart with the following features:

- A. Open
- B. (3) Shelf, shelf size 33" x 21"
- C. U-shaped frame
- D. All-welded stainless-steel construction
- E. 700 lb. capacity
- F. (2) 5" Swivel & (2) 8" fixed casters

Utility cart to be as manufactured by Lakeside Manufacturing, Model No. 544, Piper, or Carlisle.

ITEM 20

NOT USED

ITEM 21 WORK TABLE

QUANTITY AS SCHEDULED

Provide work table having the following features:

- A. 84"W x 30"D
- B. 14/300 Series stainless steel top, rolled edge on front & back
- C. Adjustable 18/300 series stainless steel undershelf with marine edge
- D. Locking gusset system
- E. (4) Stainless steel legs, caster mounted
- F. Caster stabilizing device
- G. (1) Drawer assembly

Worktable is to be manufactured by Eagle Group, Model T3084SE, John Boos, or Premier Stainless.

ITEM 22 MOP SINK CABINET

QUANTITY AS SCHEDULED

Provide a single width mop cabinet with the following features:

- A. 30"W x 30"D x 84"H
- B. Enclosed cabinet with open back for plumbing
- C. (2) Lockable louvered swing doors
- D. 24" x 24" x 12" deep mop sink with drain
- E. Overhead shelf
- F. Rear-mounted mop holder with (3) locking cams
- G. Service faucet with vacuum breaker and 120" hose
- H. 18/300 Stainless steel
- I. (2) Shelf mounted mop holders

Mop cabinet to be as manufactured by John Boos, Model No. PBJC-303084-X, Titan Stainless, or IMC Teddy.

ITEM 23 AIR CURTAIN

QUANTITY AS SCHEDULED

Provide air curtain with the following features:

- A. For 36" wide door
- B. Unheated
- C. Galvanized steel cabinet
- D. Obsidian black powder coat finish
- E. Voltage as scheduled, direct connection
- F. Microswitch at door

Air curtain to be as manufactured by Mars Air Systems, Model No. LPN236-1UA-OB, Curtron, or Berner.

END OF SECTION 11 40 00

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SECTION 11 49 00 - GYMNASIUM EQUIPMENT

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES:

- A. Provide labor, material, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to the following gymnasium equipment:
 - 1. Basketball equipment.
 - 2. Volleyball and Pickleball equipment.
 - 3. Safety pads.

1.3 REFERENCE STANDARDS

- A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; Current Edition.
- B. ANSI A208.2 - Medium Density Fiberboard (MDF) for Interior Applications; 2022.
- C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
- D. ASTM A391/A391M - Standard Specification for Grade 80 Alloy Steel Chain; 2021.
- E. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
- F. ASTM B308/B308M - Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles; 2020.
- G. ASTM B429/B429M - Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube; 2020.
- H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
- I. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth; 2024.
- J. FIBA – International Basketball Federation (Federation Internationale de Basketball Amateur).
- K. FIVB – International Volleyball Federation (Federation Internationale de Volleyball).
- L. NAGWS – The National Association for Girls and Women in Sport.
- M. NCAA – The National Collegiate Athletic Association.
- N. NFHS – The National Federation of State High School Associations.
- O. USAV – USA Volleyball.

1.4 REFERENCES

- A. Refer to specification Section 01 41 00 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 ACTION SUBMITTALS

- A. See Section 01 30 00 – Administrative Requirements and Section 01 60 00 – Product Requirements for submittal procedures.
- B. Product Data: For each type of product indicated.
 - 1. If applicable, include assembly, disassembly, and storage instructions for removable equipment.
 - 2. Motors: Show nameplate data, ratings, characteristics, and mounting arrangements.

- C. Shop Drawings: For gymnasium equipment. Include plans, elevations, sections, details, attachments to other work, and the following:
 - 1. Method of field assembly for removable equipment, connections, installation details, mountings, floor inserts, attachments to other work, and operational clearances.
 - 2. Transport and storage accessories for removable equipment.
- D. Coordination Drawings: Court layout plans, drawn to scale, and coordinating floor inserts, game lines, and markers applied to finished flooring.
- E. Samples for Initial Selection: For each type of gymnasium equipment indicated.
- F. Product Certificates: For each type of gymnasium equipment, signed by product manufacturer.
- G. Qualification Data: For Installer.
- H. Operation and Maintenance Data: For gymnasium equipment to include in emergency, operation, and maintenance manuals.
- I. Warranty: Special warranty specified in this section.

1.6 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Provide products from a firm that makes the indicated products as a regular production item and with not less than ten (10) years experience.
- B. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation of specified materials and assemblies with not less than five (5) years experience.
- C. Installer Qualifications: An employer of workers trained and approved by manufacturer.
- D. Source Limitations: Obtain each type of gymnasium equipment through one source from a single manufacturer.
- E. 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.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not install gymnasium equipment until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Field Measurements: Verify position and elevation of floor inserts and layout for gymnasium equipment.
- C. Coordinate installation of floor inserts with structural floors and finish flooring installation and with court layout and game lines and markers on finish flooring.
- D. Coordinate layout and installation of overhead-supported gymnasium equipment and suspension system components with other construction including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturer and basis of design shall be the following however products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product and acceptance is provided by the Architect in writing prior to bidding.
 - 1. Porter Athletic Equipment
- B. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product.
 - 1. AALCO Manufacturing

- 2. Institutional Products, Inc.
- 3. Performance Sports Systems
- 4. Jaypro Sports
- C. Substitutions: See Section 01 60 00 for substitution procedures.
- D. General: Provide equipment complying with requirements in NFHS's "NFHS Basketball Rule Book."

2.2 BASKETBALL EQUIPMENT

- A. Basis of Design: Model 90955000 - Ceiling suspended, side fold side braced unit.
- B. Protruding fasteners or exposed bolt heads on front face of backboards are not permitted.
- C. Center Strut height adjuster: Model 00900506.
- D. Basketball Backboard: Model 208 - Rectangular Glass Backboard.
 - 1. Shape and Size:
 - a. Rectangular, 3'-6" x 6'-0".
 - 2. Material: 1/2-inch tempered plate glass cushioned in unitized steel-tubing frame. Aluminum frames without inner steel tubing frames shall not be considered as equal.
- E. General: Provide equipment complying with requirements in NFHS's "NFHS Basketball Rule Book."
- F. Padding Kit: Model 00326xxx - Pro-Pad Padding Kit.
 - 1. Attachment: Bolt on type.
 - 2. Color: As selected by Architect from manufacturers full range.
- G. Goal: Model 236154 Power-Flex II Goal.
- H. Winch: Model 713 Electric Winch.
 - 1. Motor: 1 HP; 11.4 Amps, 115 Volt.
 - 2. Control: Model 0791 1X2 Key Switch Assembly.
- I. Locking Safety Strap: Model 797 Saf-Strap:
 - 1. Capacity: 6000 pounds.
- J. Basketball Nets: 12-loop-mesh net, between 15 and 18 inches (457.2 mm) long, sized to fit rim diameter, and as follows:
 - 1. Cord: Made from white nylon. (Included with the basketball goal if used detail from Master Spec)

2.3 VOLLEYBALL AND PICKLEBALL EQUIPMENT

- A. General: Provide equipment complying with requirements in NFHS's "NFHS Volleyball Rule Book."
- B. Basis-of-Design: "19610XX Power-Rib II Volleyball Package, 3-1/2-inch OD aluminum Competitive Package Plus."
 - 1. Posts / Standards:
 - a. Volleyball Standards: Model 1971 - Pair of POWR-RIB II volleyball standards, aluminum.
 - 1) Removable, adjustable, telescoping height. Designed for easy removal from permanently placed floor insert supports. Fabricated from extruded-aluminum pipe or tubing, with non-marking plastic or rubber end cap or floor bumper to protect permanent flooring.
 - 2) Finished with manufacturer's standard factory-applied, baked powder-coating finish complying with finish manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness or plated metal finish.
 - b. Pickleball: Model 4540, 3.5-inch OD posts, (pair), steel.
 - 1) Finish: Black powder coat.

2. Floor Insert: Chrome-finished steel floor plate; and steel pipe sleeve, concealed by floor plate, with capped bottom end. Securely anchor pipe sleeve below finished floor in concrete footing; with anchors designed for securing floor insert to floor substrate indicated; one per post standard.
3. Protective Pads:
 - a. Model 8390XX Pir of Volleyball Upright Protective Pads.
 - b. Color: As selected by Architect from manufacturers full range.
4. Nets:
 - a. Volleyball: Model 2295 Universal Volleyball Net.
 - b. Pickleball: Model 2210, 21-feet x 35-feet.
5. Judges Stand: Model 669100 Judges Stand with protective pads.

2.4 SAFETY PADS

- A. Manufacturer shall be the following however products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product and acceptance is provided by the Architect in writing prior to bidding.
 1. Porter Athletic Equipment Company.
- B. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product:
 1. AALCO Manufacturing.
 2. Draper.
 3. Performance Sports Systems.
 4. Porter Athletic Equipment Company.
- C. Safety Pad Surface-Burning Characteristics: ASTM E84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 1. Flame-Spread Index: 25 or less.
 2. Smoke-Developed Index: 450 or less.
- D. Pad Coverings: Provide safety pad fabric covering fabricated from puncture- and tear-resistant, not less than 19-oz./sq. yd vinyl fabric treated with fungicide for mildew resistance; with surface-burning characteristics indicated and lined with fire-retardant liner.
- E. Wall Safety Pads: Padded wall wainscot panels designed to be attached in a continuous row; each panel section consisting of fill laminated to backer board with visible surfaces fully covered by seamless fabric covering, free of sag and wrinkles and firmly attached to back of backer board.
 1. Basis of Design: Model No. 560 DuraSafe Wall Pads.
 2. Backer Board: Manufacturers standard.
 3. Size: Each panel section, 24 inches (609.6 mm) wide by not less than 72 inches (1828.8 mm) long.
 4. Number of Panel Sections: As indicated.
 5. Installation Method: 1-inch top and bottom fabric attachment flange with exposed fasteners.
 6. Meets NFPA 101 in accordance to NFPA 286 test criteria. Pads to be tested as a complete panel under independent agency.
 7. Meets 2003 IBC Section 803.2.1 (NFPA 286).
 8. Foam: 2-inch thick, flame-retardant foam.
 9. Entire Face of Panel, Including Nailing Margins: Upholstered in 19-ounce, fire-retardant, high-tensile, vinyl-coated polyester fabric material with leather-like embossed finish.
 10. Cover Material Tear Strength: 100 psi (689.48 kPa).
 11. Cover Material Properties: Mildew resistant, rot resistant, with infection-combating fungicide.
 12. Fold and securely staple cover to backside of OSB.
 13. Color: As selected by Architect from Manufacturer's full range.

2.5 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

1. Extruded Bars, Profiles, and Tubes: ASTM B221 (((ASTM B221M))).
2. Cast Aluminum: ASTM B179.
3. Flat Sheet: ASTM B 209 (ASTM B 209M).
- B. Steel: Comply with the following:
 1. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
 2. Steel Tubing: ASTM A 500 or ASTM A 513, cold formed.
 3. Steel Sheet: ASTM A1011/A1011M.
- C. Support Cable: 1/4-inch diameter, 7x19 galvanized steel aircraft cable with a breaking strength of 7000 lb. Provide fittings complying with cable manufacturer's written instructions for size, number, and method of installation.
- D. Support Chain and Fittings: Grade 80 hardened alloy steel chain rated for overhead lifting, ASTM A391/A391M, with commercial-quality, hot-dip galvanized steel connectors and hangars.
- E. Castings and Hangers: Malleable iron, ASTM A47/A47M, grade required for structural loading.
- F. Softwood Plywood: DOC PS 1, exterior.
- G. Medium-Density Fiberboard: ANSI A208.2
- H. Anchors, Fasteners, Fittings and Hardware: Manufacturer's standard corrosion-resistant or non-corrodible units; concealed.
- I. Grout: Non-shrink, nonmetallic, premixed, factory-packaged, non-staining, noncorrosive, nongaseous grout complying with ASTM C 1107 with minimum strength recommended in writing by gymnasium equipment manufacturer.
- J. K. Submit manufacturer's product data for adhesives. Indicate VOC limits of the product. Submit MSDS highlighting VOC limits.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for play court layout, alignment of mounting substrates, installation tolerances, operational clearances, accurate locations of connections to building electrical system, and other conditions affecting performance.
 1. Verify critical dimensions.
 2. Examine supporting structure and subgrades, subfloors and footings below finished floor.
 3. Examine wall assemblies, where reinforced to receive anchors and fasteners, to verify that locations of concealed reinforcements have been clearly marked. Locate reinforcements and mark locations.
 4. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. General: Comply with manufacturer's written installation instructions and competition rules indicated for each type of gymnasium equipment. Complete equipment field assembly, where required.
- B. Unless otherwise indicated, install gymnasium equipment after other finishing operations, including painting, have been completed.
- C. Permanently Placed Gymnasium Equipment and Components: Rigid, level, plumb, square, and true; anchored securely to supporting structure; positioned at locations and elevations indicated on Shop Drawings; in proper relation to adjacent construction; and aligned with court layout.
 1. Floor Insert Location: Coordinate location with application of game lines and markers.
 2. Floor Insert Elevation: Coordinate installed heights of floor insert with installation and field finishing of finish flooring and type of floor plate.
 3. Operating Gymnasium Equipment: Verify clearances for movable components of gymnasium equipment throughout entire range of operation and for access to operating components.

- D. Floor Insert Setting: Position sleeve in oversized, recessed voids in concrete slabs. Clean voids of debris. Fill void around sleeves with grout, mixed and placed to comply with grout manufacturer's written instructions. Protect portion of sleeve above subfloor and footing from splatter. Verify that sleeves are set plumb, aligned, and at correct height and spacing; hold in position during placement and finishing operations until grout is sufficiently cured. Set insert so top surface of completed unit is flush with finished flooring surface.
- E. Wall Safety Pads: Mount with bottom edge at 4 inches (101.6 mm) above finished floor.
- F. Anchoring to In-Place Construction: Use anchors and fasteners where necessary for securing built-in and permanently placed gymnasium equipment to structural support and for properly transferring load to in-place construction.
- G. Connections: Connect automatic operators to building electrical system.
- H. Removable Gymnasium Equipment and Components: Assemble in place to verify that equipment and components are complete and in proper working order. Instruct Owner's designated personnel in properly handling, assembling, adjusting, disassembling, transporting, storing, and maintaining units. Disassemble removable gymnasium equipment after Owner has approved assembled configuration, and store units in location indicated on drawings.

3.3 ADJUSTING

- A. Adjust movable components of gymnasium equipment to operate safely, smoothly, easily, and quietly, free from binding, warp, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Lubricate hardware and moving parts.

3.4 CLEANING

- A. After completing gymnasium equipment installation, inspect components. Remove spots, dirt, and debris and touch up damaged shop-applied finishes according to manufacturer's written instructions.
- B. Replace gymnasium equipment and finishes that cannot be cleaned and repaired, in a manner approved by Architect, before time of Substantial Completion.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain gymnasium equipment. Refer to Division 1 Section "Demonstration and Training."

END OF SECTION

SECTION 12 36 61 - SOLID SURFACING COUNTERTOPS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The provisions of the General Conditions, Supplementary Conditions, Drawings, Specifications, and the Sections included under Division 1, General Requirements and References are included as a part of this Section as though bound herein.

1.2 SECTION INCLUDES

- A. Provide labor, materials, services, and equipment necessary to furnish and install work as indicated and as specified herein, which includes, but is not limited to:
 - 1. Solid surfacing countertops.
 - 2. Accessories.

1.3 REFERENCE STANDARDS

- A. ASTM C531 - Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes; 2018.
- B. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics; 2023, with Editorial Revision.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
- D. PS 1 - Structural Plywood; 2023.
- E. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.
- F. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
- G. ASTM C531 – Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes.
- H. ASTM D256 – Izod Pendulum Impact Resistance of Plastics.

1.4 REFERENCES

- A. Refer to specification Section 01 41 00 - Regulatory Requirements for code requirements and code standards applicable to all materials and work necessary to complete the scope of work.

1.5 ACTION SUBMITTALS

- A. See Section 01 30 00 – Administrative Requirements and Section 01 60 00 – Product Requirements for submittal procedures.
- B. Product Data: Provide data for materials indicated including fabrication information and manufacturer's installation instruction.
- C. Shop Drawings: Indicate profiles of units, jointing, fastening, edge treatments, and cut-outs for sinks, accessories, and related items.
- D. Samples: Submit the following:
 - 1. One full-size solid-surface-material countertop, with front edge and backsplash, 8 by 10 inches (254 mm) of construction and in configuration specified.

1.6 INFORMATION SUBMITTALS

- A. Qualification Data: For Installer and fabricator.
- B. Sealant Compatibility Test Report: From sealant manufacturer, complying with requirements in Division 7 Section "Joint Sealants" and indicating that sealants will not stain or damage stone.
- C. Maintenance Data: For solid surface countertops to include in maintenance manuals. Include Product Data for solid surface-care products used or recommended by Installer, and names,

addresses, and telephone numbers of local sources for products. Include repair and cleaning instructions.

1.7 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Provide products from a firm that makes the indicated products as a regular production item and with not less than ten (10) years experience.
- B. Fabricator Qualifications: Manufacturer who fabricates countertops similar to work of this Project and have a minimum 5 years experience.

1.8 FIELD CONDITIONS

- A. Field Measurements: Verify dimensions of construction to receive countertops by field measurements before fabrication.
- B. Coordinate locations of utilities that will penetrate countertops or backsplashes.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver no components to project site until areas are ready for installation.
- B. Store components indoors prior to installation.
- C. Handle materials to prevent damage to finished surfaces.
 - 1. Provide protective coverings to prevent physical damage or staining following installation for duration of project.

1.10 WARRANTY

- A. Provide manufacturer's warranty against defects in materials.
 - 1. Warranty shall provide material and labor to repair or replace defective materials.
 - 2. Damage caused by physical or chemical abuse or damage from excessive heat will not be warranted.
- B. Manufacturer's warranty period:
 - 1. Ten (10) years from date of substantial completion.

1.11 PERFORMANCE

- A. Fire Test Response Characteristics:
 - 1. Provide with the following Class A (Class I) surface burning characteristics as determined by testing identical products per UL 723 ((ASTM E84))) or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - a. Flame Spread Index: 25 or less.
 - b. Smoke Developed Index: 450 or less.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturer and basis of design shall be the following however products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product and acceptance is provided by the Architect in writing prior to bidding.
 - 1. Dupont Company
- B. The following manufacturers are acceptable provided they equal or exceed the material requirements and functional qualities of the basis of design product.
 - 1. Wilsonart
 - 2. Samsung Staron

2.2 MATERIAL

- A. Basis of Design: "Corian"
- B. Solid polymer components

1. Cast, nonporous, filled polymer, not coated, laminated or of composite construction with through body colors meeting ANSI Z124.3 or ANSI Z124.6, having minimum physical and performance properties specified.
 2. Superficial damage to a depth of 0.010 inch (0.25 mm) shall be repairable by sanding and/or polishing.
- C. Pattern: Everest.
- D. Finish: Premium.
- E. Thickness: 3/4"
- F. Countertop Edge Style:Eased.

2.3 ACCESSORIES

- A. Plywood: Exterior 3/4" softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded. Provide a full depth and width substrate board for sub-counter.
- B. Joint adhesive: Manufacturer's standard one- or two-part adhesive kit to create inconspicuous, nonporous joints.
- C. Sealant: Manufacturer's standard mildew-resistant, FDA-compliant, NSF 51-compliant, UL-listed silicone sealant in colors matching components.

2.4 FACTORY FABRICATION

- A. Shop assembly all components possible.
- B. Fabricate components to greatest extent practical to sizes and shapes indicated, in accordance with approved shop drawings and manufacturer's printed instructions and technical bulletins.
- C. Form joints between components using manufacturer's standard joint adhesive without conspicuous joints. Reinforce with strip of solid polymer material, 2" wide.
- D. Provide factory cutouts for plumbing fittings and bath accessories as indicated on the drawings. Reinforce with strip of solid polymer material, 2" wide.
- E. Rout and finish component edges with clean, sharp returns.
1. Rout cutouts, radii, and contours to template.
 2. Smooth edges.
 3. Repair or reject defective and inaccurate work.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with fabricator present for compliance with requirements for installation tolerances and other conditions affecting performance of work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install components plumb and level, in accordance with approved shop drawings and product installation details.
1. Flat and true to within 1/16" of a flat surface over a 4' length and 1/8" of a flat surface over a 10' length.
 2. Allow a minimum of 1/16" to a maximum of 1/8" clearance between surface and each wall.
 3. Joints shall be flush with no discernable difference between the two joined surfaces.
- B. Provide product in the largest pieces available.
- C. Form field joints using manufacturer's recommended adhesive, with joints inconspicuous in finished work.
1. Exposed joints/seams shall not be allowed.

- D. Reinforce field joints with solid surface strips extending a minimum of 1 inch (25.4 mm) on either side of the seam with the strip being the same thickness as the top.
- E. Cut and finish component edges with clean, sharp returns.
- F. Rout radii and contours to template. Seal edges of cutouts in plywood by saturating with varnish.
- G. Align adjacent countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop.
- H. Carefully dress joints smooth, remove surface scratches and clean entire surface.

3.3 CLEANING AND PROTECTION

- A. Keep components clean during installation.
- B. Remove adhesives, sealants, and other stains.

END OF SECTION

SECTION 21 00 50
COMMON WORK RESULTS FOR FIRE PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
1. General provisions.
 2. Scope.
 3. Permits and Fees.
 4. Visit to Job Site.
 5. Workmanship.
 6. Drawings and Specifications.
 7. Tests.
 8. Allowance for added work.
 9. Incidental construction work.
 10. Access doors
 11. Supervision.
 12. Electrical work by others.
 13. Existing facilities, utilities, etc.
 14. Adaptation of work to existing conditions.
 15. Renovations/alterations.
 16. Submittal procedures.
 17. Product requirements.
 18. Closeout procedures.
 19. Operation and Maintenance Manuals.
 20. As-built Documents.
 21. Demonstration and Training.
 22. Warranty.
 23. Commissioning Support.

PART 2 - NOT APPLICABLE

PART 3 - EXECUTION

3.1 GENERAL PROVISIONS

- A. This Contractor's attention is directed to the requirements of Instructions to Bidders, General Conditions and Supplementary General Conditions as bound in the specifications which apply in full to the plumbing work.
- B. Where the requirements of this Division conflict with other articles in these Specifications, the Contractor shall utilize the more stringent method.

3.2 SCOPE

- A. Provide all labor, materials, tools, equipment, and transportation, and perform all operations necessary for and reasonably incidental to proper execution and completion of all "Fire Protection" work, whether specifically mentioned or not, all as indicated, specified herein, and/or implied thereby to carry out the apparent intent thereof.
- B. These drawings may be superseded by later revised or detailed drawings, specifications, or sketches prepared by the Designer, as needed for clarification, and this Contractor shall conform to all reasonable coordination requests.
- C. All items not specifically mentioned in the specifications or noted on the drawings, but which obviously are required to make the working installation complete, shall be included automatically.
- D. For projects which are bid or awarded as Single Prime contracts, organization of the Specifications into divisions, sections, and articles, and arrangement of the Drawings shall

not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be done by any trade, unless specifically shown or noted otherwise.

3.3 PERMITS AND FEES

- A. This Contractor shall secure all permits required for the completion of this contract. He shall obtain and deliver to the Owner all certificates of inspection issued by the authorities having jurisdiction.

3.4 VISIT TO JOB SITE

- A. Before submitting a bid, this Contractor shall visit the job site for the purpose of thoroughly examining the site and conditions under which the work must be performed.
- B. The submission of a bona fide bid will be construed to mean that this Contractor understands and is satisfied with conditions under which the contract must be fulfilled.
- C. No extra compensation will be allowed for situations arising from failure of this Contractor to be thoroughly familiar with site conditions, including charges and requirements for connection to utilities as shown for this project.

3.5 WORKMANSHIP

- A. Workmanship in the fabrication, preparation, and installation of materials and equipment shall conform to the best standards of practice of the trades involved.
- B. Work shall be performed by experienced and skilled mechanics under the supervision of a competent foreman.
- C. Substandard workmanship will be cause for rejection of work and replacement by Contractor.
- D. The Contractor shall reimburse the Designer for all costs incurred by the Designer due to Contractor's substandard or non-conforming work.

3.6 DRAWINGS AND SPECIFICATIONS

- A. The drawings show the location and arrangement of fixtures, piping, and equipment, together with details of connections of certain principal items.
- B. The layout shown shall be followed as closely as circumstances will permit, but this Contractor shall lay out his work so as to avoid conflict with other Contractors and trades, and to avoid any unnecessary cutting or damage to walls, floors, and supporting structural members.
- C. This Contractor shall carefully and accurately locate all sleeves and install at the proper time all necessary hangers, inserts, etc., which will be required for the completion of his work, and shall be solely responsible for the accurate and proper location of above items.
- D. This Contractor shall refer to architectural, mechanical, and electrical drawings and shall cooperate fully with other Contractors and trades while installing piping, fixtures, and other equipment because of close space limits.
 - 1. In case of conflict, notify Designer before proceeding with installation.
 - 2. Refer to architectural drawings for exact building dimensions and location of partition walls, doors, chases, etc.
 - 3. Plumbing drawings are not to be scaled for such dimensions.
- E. The drawings and specifications complement each other and together are intended to give a complete description of the work.
 - 1. Any item of equipment or note of work to be done as shown on plans and not mentioned in the specifications, or mentioned in specifications and not shown in plans, shall be furnished the same as if mentioned or shown in both places.
 - 2. If conflicts exist, then the most stringent method shown or described shall apply.
- F. Any switches, controls, or equipment included in this contract work (drawings and/or specifications) that are not specifically shown on drawings shall be located for convenient use and access.

- G. Contractor shall coordinate all equipment arrangement and lay-out in field prior to beginning any actual installation of his work.
- H. If Contractor notes any discrepancy, omission, or conflict found in plans or specifications, he shall call to the immediate attention of the Designer, prior to receipt of bids.
- I. It is the intention that piping, air ducts and light fixtures are designed and laid out to clear each other.
 - 1. It shall be the responsibility of this Contractor to coordinate his work with that of other trades to avoid any such conflicts.
 - 2. Any conflicts that occur after work of one trade is installed and was not prior coordinated shall be relocated or rearranged at the total expense of this Contractor, as directed by Designer.
 - 3. Any conflicts that cannot be corrected in field by relocation or elevation changes shall be reported to the Designer in writing prior to any installation.
- J. The drawings are not intended to show each and every complete or accurate detail.
 - 1. The figures and writing on drawings shall be taken instead of scaling.
 - 2. It is this Contractor's responsibility to comply with the evident intent for centering and symmetric arrangement.
 - 3. This Contractor shall take and be responsible for all field measurements.
 - 4. Exact locations and relations are to be defined in the field and shall be satisfactory to the Designer.
- K. Because of the small scale of plumbing drawings it is not possible to indicate all offsets, fittings, and accessories which may be required.
 - 1. Investigate structural and finish conditions affecting this work and arrange work accordingly, providing such fittings and accessories that may be required to meet the conditions.

3.7 TESTS

- A. The Designer reserves the right to conduct acceptance tests of all equipment, piping, or any other work furnished under these specifications to determine the fulfillment of special requirements.
 - 1. Such tests shall be conducted in the presence of authorized representatives of the Contractor, Owner, Engineer, and Architect at such time as the Designer may designate.
 - 2. This Contractor shall perform all tests, bear cost of same and make adjustments of equipment and wiring as may be deemed necessary by the Designer.

3.8 ALLOWANCE FOR ADDED WORK

- A. Before proceeding with any work for which compensation may be claimed or the Owner may claim credit, a detailed estimate shall first be submitted and approved in writing.
 - 1. No claim for addition to the contract sum will be valid unless so ordered and approved by the Owner and Designer, prior to start of work.
 - 2. Any conflicts corrected by relocation or elevation changes do not constitute extra work.

3.9 INCIDENTAL CONSTRUCTION WORK

- A. All blocking for openings for piping in concrete floors, masonry walls or partitions shall be provided by this Contractor.
 - 1. This Contractor shall do all cutting and fitting of his work and of other work that may be required to make the several parts come together properly and to fit his work to receive or be received by the work of other Contractors as shown upon, or reasonably implied by the drawings and specifications.
 - 2. He shall properly complete and finish up his work after other Contractors have finished as the Designer may direct.

- B. All excavating required for the installation of this system shall be done by this Contractor.
 - 1. Backfill shall be accomplished as specified in appropriate section of specifications.
 - C. Chases are prohibited in masonry walls which are not to be plastered or paneled.
 - 1. Set piping, blocking, carriers, etc. indicated to be concealed before walls are constructed in order that walls may be constructed around them.
 - 2. This Contractor shall furnish all sleeves in floors, beams, walls, etc., for each such penetration as needed for installing his work and installation of sleeves by General Contractor.
 - D. Unless otherwise noted, the General Contractor will provide openings and lintels as new construction progresses, but this Contractor shall fully designate his requirements prior to construction.
 - 1. Failure to furnish his requirements prior to building construction and failure to coordinate his work with the building construction shall make this Contractor responsible for removing, replacing and painting building construction as required for installation of his work.
- 3.10 ACCESS DOORS
- A. Provide and install access doors in walls, ceilings, etc. as required for access to valves and other devices requiring access in ceilings, chases, soffits, etc.
 - B. Access doors in non-fire rated walls or ceilings shall be as follows:
 - 1. Nominal 24" x 24" minimum size.
 - 2. 16-gage steel frame with 14-gage door panel and galvanized steel drywall bead.
 - 3. Flush style with provision to conceal flange with drywall cement.
 - 4. Double-acting concealed spring hinges to allow opening to 175 degrees.
 - 5. Flush, Allen-head operated with steel cam.
 - 6. Gray prime-painted steel, for painting to match adjacent finished surfaces.
 - 7. Basis of Design: Milcor Style DW; Comparable Products by Karp, Elmdor, Acudor.
 - C. Access doors in fire-rated walls or ceilings shall be as follows:
 - 1. Nominal 24" x 24" minimum size.
 - 2. UL 1-1/2 hour, Class B fire rating.
 - 3. Prime-painted stainless steel: 16-gage frame with 20-gage door panel, for painting to match adjacent finished surfaces.
 - 4. 2" mineral fiber insulation between inner and outer panel.
 - 5. Continuous hinge, steel with stainless steel pin.
 - 6. Self-closing and self-latching panel closer.
 - 7. Flush mounted paddle latch and locking system with flush, key-operated cylinder lock with two keys.
 - 8. Basis of Design: Milcor Style UFR; Comparable Products by Karp, Elmdor, Acudor.
- 3.11 SUPERVISION
- A. This Contractor shall have in charge of the work at all times during construction a thoroughly competent foreman with extensive experience in the work to be performed under this contract.
 - 1. Anyone deemed not capable by the Designer shall be replaced immediately upon request, and after satisfactory foreman has been assigned, he shall not be withdrawn without the written consent of the Designer.
- 3.12 ELECTRICAL WORK BY OTHERS
- A. Refer to the drawings for the details of locations of circuit breakers, junction boxes, disconnect switches, conduits and slack wire required where this contractor's electrical work terminates and electrical work by others begins.
 - B. Fire Protection Contractor is to provide and install tamper and flow switches to be wired by Electrical Contractor to fire alarm system.

3.13 EXISTING FACILITIES

- A. In existing facilities, disruption of operations must be kept to a minimum and coordinated with Owner.
 - 1. Work in existing buildings must be cleaned up daily immediately after finishing that portion of work and equipment left in order for Owner to continue operations.
 - 2. When it is necessary to interrupt utility services in the fulfillment of this contract, such interruptions shall be kept to a minimum and coordinated with Owner.
 - 3. Once work has begun, it shall be pursued diligently until completed.
- B. Every precaution shall be taken to prevent damage to existing underground lines and structures and public utilities.
 - 1. Damage to existing water and sewer lines, culverts, service connections, underground cables, and similar surface and sub-surface structures shall be at the risk of this Contractor, whether or not locations thereof are shown on plans, and the repairing of such damage shall be by this Contractor and shall be completed without delay.
 - 2. Compensation for such repairs shall be based on normal and reasonable costs.
- C. The locations of any existing underground utilities that are shown are in an approximate way only and have not been independently verified by the Owner or its representative.
 - 1. The Contractor shall determine the exact location of all existing utilities before commencing work, and agrees to be fully responsible for any and all damages which might be occasioned by the Contractor's failure to exactly locate and preserve any and all underground utilities.

3.14 ADAPTATION OF WORK TO EXISTING CONDITIONS

- A. It is reasonably implied that this Contractor shall furnish all labor and materials to provide Owner with a new and satisfactory system in these facilities.
 - 1. Contractor is to include necessary work for adaptation of equipment to conditions that may be found to produce conflicts during construction.
 - 2. When any such conditions are encountered, this Contractor is to consult with Designer and then modify installation as directed without additional costs, and to include any incidental materials required.

3.15 RENOVATIONS/ALTERATIONS

- A. Before any work is started in existing building, Fire Protection Contractor shall make a thorough survey with Designer and a representative of the Owner of building in which alterations occur and areas which are anticipated routes of access, and furnish a report, signed by all three to Designer. This report shall list by rooms and spaces:
 - 1. Existing conditions and types of resilient flooring, doors, windows, wall and other surfaces not required to be altered throughout and affected areas of building.
 - 2. Existence and conditions and operation of items such as plumbing fixtures, water heaters, valves, etc., required by drawings to be either reused for relocated, or both.
 - 3. Any discrepancies between drawings and existing conditions at site.
 - 4. Areas for working space, materials storage and routes of access to areas within buildings where alterations occur and which have been agreed upon by Contractor and Designer.
- B. Any items required by drawings to be either reused or relocated or both, found during this survey to be nonexistent, or in opinion of Designer and Owner's representative, to be in such condition that their use is impossible or impractical, shall be removed and a proposal submitted by Contractor to replace with new items in accordance with specifications which will be furnished by Designer.

- C. Re-Survey: Fifteen days before expected partial or final inspection date, Contractor, Designer, Owner's representative, together shall make a thorough re-survey of the areas of buildings involved.
 - 1. They shall furnish a report on conditions then existing, of plumbing fixtures, equipment, etc. as compared with conditions of same as noted in first condition survey report.
 - 2. Re-survey report shall also list any damage caused by this Contractor to such flooring and other surfaces, despite protection measures; and, will form basis for determining extent of repair work required of this Contractor to restore damage caused by Contractor's workmen in executing work of this Contract.
- 3.16 SUBMITTAL PROCEDURES
 - A. Coordinate preparation and processing of submittals with performance of construction activities.
 - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 - 2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
 - 3. Designer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
 - B. Contractor approval: Affix review stamp to cover sheet, with initials and date of Contractor's approval of submittals.
 - 1. By submitting Shop Drawings, Product Data, Samples and similar submittals, this Contractor represents that the Contractor has determined and verified materials, field measurements and field construction criteria and details related thereto, or will do so, and has checked and coordinated the information contained within such submittals with the requirements of the Work, the Contract Documents and the Work of other trades.
 - C. Comply with requirements in Division 01 Sections for list of submittals and time requirements for scheduled performance of related construction activities.
 - D. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows.
 - 1. Time for review shall commence on Designer's receipt of submittal.
 - 2. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
 - 3. Allow 21 days for initial review of each submittal.
 - a. Allow additional time if coordination with subsequent submittals is required.
 - b. Designer will advise Contractor when a submittal being processed must be delayed for coordination.
 - 4. Allow 15 days for review of each resubmittal.
 - E. Identification: Identify submittals as required in Division 01 sections.
 - F. Deviations: Highlight, encircle, or otherwise specifically identify deviations from the Contract Documents on submittals.
 - 1. Summarize deviations on transmittal or List of Deviations included with submittal.
 - G. Coordinate first paragraph and subparagraph below with office policy. Marking numerous copies of submittals can be time consuming.
 - H. Transmittal: Package each submittal individually and appropriately for transmittal and handling.
 - 1. Transmit each submittal using a transmittal form.

2. Designer will discard submittals received from sources other than Contractor.
- I. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
 1. Note date and content of previous submittal.
 2. Note date and content of revision in label or title block and clearly indicate extent of revision.
 3. Resubmit submittals until they are marked "Furnish as Submitted" or "Furnish as Corrected."
 4. Where submittals contain specific questions or comments, provide a separate sheet with specific answers to each question or comment.
- J. At Contractor's written request, copies of Designer's CAD files will be provided to Contractor for Contractor's use in connection with Project, subject to the following conditions:
 1. Allow 21 days from Designer's receipt of written request for CAD files for delivery of files
 2. Files will be delivered via email or compact disc.
 3. Files will be delivered without RN&M Title Blocks, standard details, schedules, etc.
 4. CAD files provided for Contractor's use are not to be construed as the Contract Documents. Use of CAD files for submittals or other uses are at the Contractor's risk.
- K. Prepare and submit Action Submittals required by individual Specification Sections.
 1. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
 2. Number of Copies: Submit at least eight copies of Product Data, unless otherwise indicated.
 - a. Designer will return all but three copies.
 - b. Retain or duplicate sufficient copies for inclusion in Operation and Maintenance Manuals.
 3. Shop Drawings: Prepare Project-specific information, drawn accurately to scale.
 - a. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data, unless submittal of Designer's CAD Drawings is otherwise permitted.
 4. Revise subparagraph below to establish a standard sheet size and format.
 5. Sheet Size: At least 8-1/2 by 11 inches but no larger than size of project drawings.
 6. Subparagraph below assumes Architect and Contractor will make copies from opaque print.
 7. Number of Copies: Two opaque (bond) copies of each submittal. Designer will return one copy.
 8. Manufacturers and Materials Suppliers List: Submit three copies of manufacturers and materials suppliers list within 20 days of Contract Award, unless otherwise indicated. Designer will return two copies.
 9. If needed, combine subcontract list in paragraph below with product list above. Subcontract list is required by AIA Document A201 to be submitted as soon as practical after award of the Contract.
 10. Subcontract List: Submit within 20 days of Contract Award three copies of list of proposed subcontractors. Designer will return two copies. Subcontract list to include all tiers of subcontractors.
- L. Contractor's Review and Approval: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents.
 1. Note corrections and field dimensions.
 2. Mark with approval stamp before submitting to Designer.

- M. Designer's Action: Designer will not review submittals that do not bear Contractor's approval stamp and will return them without action.
 - 1. Designer will review each submittal, make marks to indicate corrections or modifications required, and return it.
 - 2. Designer will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken, as follows:
 - a. Furnish as Submitted
 - b. Furnish as Corrected: Incorporate comments marked on or attached to submittal.
 - c. Revise and Resubmit: Major items of the submittal do not comply, requiring a resubmittal.
 - N. Partial submittals are not acceptable, will be considered nonresponsive, and will be returned without review.
 - O. Submittals not required by the Contract Documents may not be reviewed and may be discarded.
 - P. The Contractor is responsible for compliance with the Contract Documents, dimensions, details, coordination, and satisfactory performance of materials and equipment provided and installed.
- 3.17 PRODUCT REQUIREMENTS
- A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - 1. Basis-of-Design Product: Item identified by manufacturer's product name, make, and model number, used to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, dimensions, and other characteristics for purposes of evaluating comparable products of other named manufacturers.
 - 2. Comparable Product: Product that is listed in the Contract Documents, or added by Addendum, and demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified or basis-of-design product.
 - 3. Owner-preferred Alternate Product: Product that is listed in the Contract Documents, and for which an Alternate Bid price is submitted. When an Alternate Bid item is accepted in the Contract, no substitutions will be allowed.
 - 4. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor after award of Contract.
 - 5. New Products: Items that have not previously been incorporated into another project or facility, except that products consisting of recycled-content materials are allowed, unless explicitly stated otherwise. Products salvaged or recycled from other projects are not considered new products.
 - B. Comparable Product Requests: Submit three copies of each request for consideration, at least 10 days prior to receipt of bids, for products not listed in the Contract Documents. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Documentation: Show compliance with requirements for Comparable Products and the following, as applicable:

- a. 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 product.
 - b. Detailed comparison of significant qualities of proposed product 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.
 - c. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 2. Designer's Action: If necessary, Designer will request additional information or documentation for evaluation. Designer will notify Contractor of approval or rejection of proposed comparable product request.
 - a. Form of Approval: Addition of the item to the list of Comparable Products by Addendum, prior to receipt of bids.
 - b. Use product specified if Designer cannot make a decision on use of a comparable product request within time allocated.
- C. 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.
 1. Provide products complete with accessories, trim, finish, fasteners, features, options, and other items needed for a complete installation and indicated use and effect, and as required or recommended by the manufacturer for a complete installation, whether or not specifically indicated on the drawings or specifications.
 2. 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.
 3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
 4. Where products are accompanied by the term "as selected," Designer will make selection.
 5. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.
- D. Product Selection Procedures:
 1. Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed that complies with requirements.
 2. Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.
 3. Basis-of-Design Product: Where Specifications name a product and include a list of manufacturers, provide the specified product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named.
- E. Responsibility of the Contractor: The responsibility for determining dimensions, utility requirements, fitting of work with other trades, sequencing and coordination of work, for Product Substitutions and Comparable Products rests solely with the Contractor.
- F. Manufacturer's Warranties: Where specifications require manufacturer's warranties, the provisions of the Contract Documents take precedence over any manufacturer's "standard" warranty provisions, exclusions, etc.

1. The start of manufacturer's warranties shall be the date of Substantial Completion of the project or phase of the project, notwithstanding any language or exclusion in any document submitted by the contractor or manufacturer.
- 3.18 CLOSEOUT PROCEDURES
- A. Substantial Completion: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.
 1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
 2. Complete startup testing of systems.
 3. Submit test records.
 4. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
 5. Complete final cleaning requirements, including touchup painting.
 6. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
 7. Submit a written request for inspection for Substantial Completion. On receipt of request, Designer will either proceed with inspection or notify Contractor of unfulfilled requirements.
 8. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
 9. Results of completed inspection will form the basis of requirements for Final Completion.
 - B. Final Completion: Before requesting final inspection for determining date of Final Completion, complete the following:
 1. Submit certified copy of Designer's Substantial Completion inspection list of items to be completed or corrected (punch list). The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 2. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit documentation of training.
 3. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Designer will either proceed with inspection or notify Contractor of unfulfilled requirements.
 4. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
 - C. Cleaning: This Contractor shall provide all systems and equipment in a new and clean condition.
 1. Clean all items furnished and installed in accordance with manufacturer's recommendations.
 2. Provide instruction to Owner in proper cleaning of all items provided as part of this Division.
 3. Cooperate with General Contractor in cleaning of building.
- 3.19 OPERATION AND MAINTENANCE MANUALS
- A. Submit four complete copies of Operation and Maintenance Manuals to Designer for review prior to request for inspection for Substantial Completion.
 - B. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain a title page, table of contents, and manual contents.
 - C. Title Page: Enclose title page in transparent plastic sleeve. Include the following information:

1. Subject matter included in manual.
 2. Name and address of Project.
 3. Name and address of Owner.
 4. Date of submittal.
 5. Name, address, and telephone number of Contractor.
 6. Name and address of Architect.
 7. Name and address of Engineer.
- D. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
- E. List of Material Suppliers and Subcontractors: List contact information for each material supplier and subcontractor.
- F. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
1. Binders: Heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
 - a. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.
 2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
 3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.
 4. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
 - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
 - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.
- G. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.
- H. Descriptions: Include the following: Product name and model number, Manufacturer's name, Equipment identification with serial number of each component, Equipment function, Operating characteristics, Limiting conditions, Performance curves, Engineering data and tests, Complete nomenclature and number of replacement parts.
- I. Include start-up, break-in, and control procedures; stopping and normal shutdown instructions; routine, normal, seasonal, and weekend operating instructions; and required sequences for electric or electronic systems.
- J. Describe the sequence of operation, and diagram controls as installed.
- K. List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list

- name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.
- L. Provide manufacturers' maintenance documentation including maintenance instructions, drawings and diagrams for maintenance, nomenclature of parts and components, and recommended spare parts for each component part or piece of equipment:
 - M. Include test and inspection instructions, troubleshooting guide, disassembly instructions, and adjusting instructions that detail essential maintenance procedures:
 - N. Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
 - O. Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
 - P. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 - Q. Provide complete approved submittal data with all annotations.
 - R. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in Record Drawings to ensure correct illustration of completed installation.
- 3.20 AS-BUILT DOCUMENTS
- A. As-built Marked Prints: Maintain one set of blue- or black-line white prints of the Contract Drawings.
 - 1. Mark Record Prints to show the actual installation where installation varies from that shown originally.
 - 2. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up As-built Marked Prints.
 - 3. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - 4. Record data as soon as possible after installation.
 - 5. Record and check the markup before enclosing concealed installations.
 - 6. Indicate dimensions to locate underground and concealed conduits and lines from fixed reference points.
 - 7. Indicate burial depth for underground lines.
 - 8. Indicate location of all valves and cross-reference to valve tag list.
 - 9. Mark the Contract Drawings completely and accurately.
 - a. Mark record sets with erasable, red-colored pencil.
 - b. Note Addendum numbers, Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
 - 10. Maintain As-built Marked Prints in a clean, legible, up-to-date condition in the project office, and available to the Designer for inspection upon request throughout construction.
 - 11.
 - 12. In first paragraph and subparagraphs below, architects may want to delete titleblock information from CAD files provided to Contractor. See Evaluations. Consult Owner for format required.
 - B. Record Specifications: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 2. Note related Change Orders and As-built Marked Prints where applicable.
- 3.21 DEMONSTRATION AND TRAINING
- A. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
 - B. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season. Schedule training with Owner with at least seven days' advance notice.
 - C. Warranty service: Train Owner in repair and troubleshooting during each warranty service call.
 - D. For each training session, submit on letterhead name of trainer, date of training, names of Owner's personnel trained, and systems/equipment trained on.
 - E. For factory training, documentation to be on letterhead of organization conducting training.
- 3.22 WARRANTY
- A. This Contractor shall guarantee all materials, equipment, workmanship and each and every piece of apparatus which he furnished and which he installs under this contract against defects and failures of any nature for a period of one year from date on which the system is accepted.
 - B. Apparatus furnished by this Contractor shall be guaranteed to be satisfactory when operated under rated conditions in accordance with manufacturer's instructions and to be of size, function, and capacity specified on drawings or in the specifications.
 - C. Equipment manufacturers shall warrant equipment furnished for this project for same time span as installing contractors warranty period as set above and elsewhere in these specifications.
 1. Warranty start date shall be as established by the Designer. Refer to General Conditions, Supplementary General Conditions, and Division 1 specifications for establishment of warranty start dates.
 2. The provisions of the Contract Documents supersede and override any manufacturer's standard warranty provisions.
 - D. Upon notice from the Designer or Owner, Contractor shall immediately check system, make necessary repairs or adjustments as required; due to faulty workmanship, materials, faults, operation or equipment, without cost to the Owner, and instruct Owner in proper operation, adjustment, and care of systems.
 - E. During the one-year warranty period, the Contractor shall be responsible for all preventive maintenance, including routine lubrication, filter changing, inspections, and adjustments.
 1. Contractor shall provide all materials, consumables, equipment, supplies, etc. required for preventive maintenance.
 2. Perform preventive maintenance in accordance with manufacturer's recommendations.
 3. Near the end of the warranty period, conduct the required annual test/inspection of the sprinkler system.
 4. During preventive maintenance, instruct Owner in proper preventive maintenance procedures.
 - F. The Contractor shall submit service call tickets, reports, or other documentation of each warranty service call to the Designer.
- 3.23 COMMISSIONING SUPPORT
- A. This contractor shall support all Commissioning as requested by the Commissioning Agent, to include but not limited to the following:
 1. Performance tests

2. Piping tests as requested
 3. Factory startup of equipment
 4. Any commissioning activity, as requested by the Commissioning Agent.
- B.

SECTION 21 00 80

PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for Project Record Documents, including the following:
 - 1. Record Drawings.
 - 2. Record Specifications.
- B. See Division 21 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
- C. See Division 21 Sections for specific requirements for Project Record Documents of the Work in those Sections.

1.2 SUBMITTALS

- A. Record Drawings: Comply with the following:
 - 1. Number of Copies: Submit one set of marked-up Record Prints.
- B. Record Specifications: Submit one copy of Project's Specifications, including addenda and contract modifications.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

- A. Record Prints: Maintain one set of blue- or black-line white prints of the Contract Drawings and Shop Drawings.
 - 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. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
 - c. Indicate dimensions to locate underground and concealed lines from fixed reference points.
 - d. Indicate burial depth for underground lines.
 - 2. Mark the Contract Drawings completely and accurately.
 - 3. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
 - 4. Note Addendum numbers, Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Format: Identify and date each Record Drawing; include the designation "AS-BUILT MARKED PRINT" in a prominent location.
 - 1. Record Prints: Organize Record Prints and newly prepared Record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.

2. Identification: As follows:
 - a. Project name.
 - b. Date.
 - c. Designation "AS-BUILT MARKED PRINTS."
 - d. Name of Architect.
 - e. Name of Contractor.

2.2 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 2. Note related Change Orders and Record Drawings where applicable.

2.3 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.

2.4 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

PART 3 - EXECUTION

3.1 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 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 Architect's reference during normal working hours.

END OF SECTION 210080

SECTION 21 01 00 PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes through-penetration firestop systems for penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items.

1.2 PERFORMANCE REQUIREMENTS

- A. General: For penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.
- B. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per ASTM E 814 or UL 1479:
 - 1. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.
 - 2. T-Rated Systems: For the following conditions, provide through-penetration firestop systems with T-ratings indicated, as well as F-ratings, where systems protect penetrating items exposed to potential contact with adjacent materials in occupiable floor areas:
 - a. Penetrations located outside wall cavities.
 - b. Penetrations located outside fire-resistance-rated shaft enclosures.
- C. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.
 - 1. For floor penetrations with annular spaces exceeding 4 inches in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved, either by installing floor plates or by other means.
- D. For through-penetration firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For each through-penetration firestop system, submit documentation, including illustrations, from a qualified testing and inspecting agency, showing each type of construction condition penetrated, relationships to adjoining construction, and type of penetrating item.
 - 1. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular through-penetration firestop condition, submit illustration, with modifications marked, approved by through-penetration firestop system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.
- C. Qualification Data: For Installer.

1.4 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Provide through-penetration firestop systems that comply with the following requirements and those specified in Part 1 "Performance Requirements" Article:

1. Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL, or another agency performing testing and follow-up inspection services for firestop systems acceptable to authorities having jurisdiction.
2. Through-penetration firestop systems are identical to those tested per testing standard referenced in "Part 1 Performance Requirements" Article. Provide rated systems bearing classification marking of qualified testing and inspecting agency.
- B. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.
- C. Do not cover up through-penetration firestop system installations that will become concealed behind other construction until each installation has been examined by Owner's inspecting agency and building inspector, if required by authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the through-penetration firestop systems indicated for each application on Drawings or that are produced by one of the following manufacturers:
 1. Grace, W. R. & Co. - Conn.
 2. Hilti, Inc.
 3. Johns Manville.
 4. Nelson Firestop Products.
 5. 3M; Fire Protection Products Division.
 6. Tremco; Sealant/Weatherproofing Division.
 7. USG Corporation.

2.2 FIRESTOPPING

- A. Compatibility: Provide through-penetration firestop systems that are compatible with one another; with the substrates forming openings; and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.
- B. Accessories: Provide components for each through-penetration firestop system that are needed to install fill materials and to comply with Part 1 "Performance Requirements" Article. Use only components specified by through-penetration firestop system manufacturer and approved by qualified testing and inspecting agency for firestop systems indicated.

PART 3 - EXECUTION

3.1 THROUGH-PENETRATION FIRESTOP SYSTEM INSTALLATION

- A. General: Install through-penetration firestop systems to comply with Part 1 "Performance Requirements" Article and with firestop system manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. Install forming/damming/backing materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.
- C. Install fill materials for firestop systems by proven techniques to produce the following results:
 1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.

2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.2 FIELD QUALITY CONTROL

- A. Where deficiencies are found, repair or replace through-penetration firestop systems so they comply with requirements.
- B. Proceed with enclosing through-penetration firestop systems with other construction only after inspection reports are issued and firestop installations comply with requirements.

END OF SECTION 22 01 00

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SECTION 210548

VIBRATION AND SEISMIC CONTROLS FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following: Vibration and seismic restraints and seismic joints at building seismic joints.

1.2 PERFORMANCE REQUIREMENTS

- A. Seismic-Restraint Loading:
 - 1. Site Class, Assigned Seismic Use Group, and other design criteria as defined in the State Building Code: As shown on Architectural or Structural Drawings.
- B. Analysis by Professional Engineer for any Seismic joint which will be required for the seismic category as noted on the Architectural Drawings.

1.3 SUBMITTALS

- A. Calculations for Seismic joints at building joints.
- B. Product Data: For each product indicated.
- C. Delegated-Design Submittal: For vibration isolation and seismic-restraint calculations and details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- D. Welding certificates.
- E. Qualification Data: For professional engineer.

1.4 QUALITY ASSURANCE

- A. Comply with seismic-restraint requirements in the State Building Code and NFPA 13 unless requirements in this Section are more stringent.

PART 2 - PRODUCTS

- 2.1 All Products shall be per the approved delegated design.

PART 3 - EXECUTION

3.1 VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

- A. Installation shall be per requirements of the Delegated Design.

END OF SECTION 210548

SECTION 21 10 00
WATER-BASED FIRE-SUPPRESSION SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following fire-suppression piping inside the building:
 - 1. Wet-pipe sprinkler systems.
 - 2. Dry-pipe sprinkler systems.

1.2 SYSTEM DESCRIPTIONS

- A. Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device. Hose connections are included if indicated.
- B. Dry-Pipe Sprinkler System: Automatic sprinklers are attached to dry piping containing compressed air and that is connected to a dry valve which is connected to the water supply. Sprinklers open when heat melts fusible link or destroys frangible device. When the air pressure is lost on the piping system, the dry valve trips and introduces water to discharge immediately from sprinklers when they are opened.

1.3 PERFORMANCE REQUIREMENTS

- A. Standard Piping System Component Working Pressure: Listed for at least **175 psig**.
- B. Fire-suppression standpipe system design shall be approved by authorities having jurisdiction.
 - 1. Minimum Residual Pressure at Each Hose-Connection Outlet: **Per State Building Code**.
 - 2. Unless Otherwise Indicated, the Following Is Maximum Residual Pressure at Required Flow at Each Hose-Connection Outlet: **100 psig**.
- C. Fire-suppression sprinkler system design shall be approved by authorities having jurisdiction.
 - 1. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
 - 2. Sprinkler Occupancy Hazard Classifications: As shown on Drawings.
 - 3. Minimum Density for Automatic-Sprinkler Piping Design: As shown on Drawings.
 - 4. Maximum Protection Area per Sprinkler: As shown on Drawings.
 - 5. Total Combined Hose-Stream Demand Requirement: According to NFPA 13, unless otherwise indicated: As shown on Drawings.
- D. Seismic Performance: Fire-suppression piping shall be capable of withstanding the effects of earthquake motions determined according to NFPA 13 and State Building Code.

1.4 SUBMITTALS

- A. Product Data: For each product indicated.
- B. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations.
- C. Field test reports and certificates.
- D. Field quality-control test reports.
- E. Operation and maintenance data.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Installer's responsibilities include designing, fabricating, and installing fire-suppression systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.
 - 1. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer or NICET Certified Technician in accordance with State General Statutes. Indicate NICET level on all documents (Level III minimum).
- B. NFPA Standards: Fire-suppression-system equipment, specialties, accessories, installation, and testing shall comply with the following:
 - 1. NFPA 13, "Installation of Sprinkler Systems."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 STEEL PIPE AND FITTINGS

- A. Threaded-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795, with factory- or field-formed threaded ends.
1. Cast-Iron Threaded Flanges: ASME B16.1.
 2. Malleable-Iron Threaded Fittings: ASME B16.3.
 3. Gray-Iron Threaded Fittings: ASME B16.4.
 4. Steel Threaded Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, seamless steel pipe. Include ends matching joining method.
 5. Steel Threaded Couplings: ASTM A 865.
- B. Grooved-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795, with factory- or field-formed, square-cut- or roll-grooved ends.
1. Grooved-Joint Piping Systems:
 - a. Manufacturers:
 - 1) Anvil International, Inc.
 - 2) Central Sprinkler Corp.
 - 3) Victaulic Co. of America.
 - b. Grooved-End Fittings: UL-listed, ASTM A 536, ductile-iron casting with OD matching steel-pipe OD.
 - c. Grooved-End-Pipe Couplings: UL 213 and AWWA C606, rigid pattern, unless otherwise indicated; gasketed fitting matching steel-pipe OD. Include ductile-iron housing with keys matching steel-pipe and fitting grooves, rubber gasket listed for use with housing, and steel bolts and nuts.

2.3 BRAIDED FLEXIBLE CONNECTORS

- A. Braided flexible connectors to sprinkler heads are allowed. Include 175-psig minimum working-pressure rating and ends. Unbraided flexible connectors are not allowed. All hose assemblies are to be FM approved.
- B. Manufacturers:
1. Victaulic
 2. Sprinkleflex
 3. Flex Drop
- C. Stainless-Steel-Hose/Steel Pipe, Flexible Connectors: Stainless-steel, inner tubing covered with stainless-steel wire braid. Include steel nipples or flanges, welded to hose.

2.4 SPRINKLER SPECIALTY FITTINGS

- A. Sprinkler specialty fittings shall be UL listed or FMG approved, with 175-psig minimum working-pressure rating, and made of materials compatible with piping.
- B. Outlet Specialty Fittings:
1. Manufacturers:
 - a. Anvil International, Inc.
 - b. Central Sprinkler Corp.
 - c. Victaulic Co. of America.
 2. Mechanical-T and -Cross Fittings: UL 213, ductile-iron housing with gaskets, bolts and nuts, and threaded, locking-lug, or grooved outlets.
 3. Snap-On and Strapless Outlet Fittings: UL 213, ductile-iron housing or casting with gasket and threaded outlet.
- C. Drop-Nipple Fittings: UL 1474, adjustable with threaded inlet and outlet, and seals.
1. Manufacturers:
 - a. CECA, LLC.

- b. Merit.
- 2.5 LISTED FIRE-PROTECTION VALVES
 - A. Valves shall be UL listed or FMG approved, with 175-psig minimum pressure rating.
 - B. Butterfly Valves: UL 1091.
 - 1. NPS 2 and Smaller: Bronze body with threaded ends.
 - a. Manufacturers:
 - 1) Global Safety Products, Inc.
 - 2) Milwaukee Valve Company.
 - 2. NPS 2-1/2 and Larger: Bronze, cast-iron, or ductile-iron body; wafer type or with grooved ends.
 - a. Manufacturers:
 - 1) Central Sprinkler Corp.
 - 2) Global Safety Products, Inc.
 - 3) Mueller Company.
 - 4) NIBCO.
 - 5) Victaulic Co. of America.
 - C. Check Valves NPS 2 and Larger: UL 312, swing type, cast-iron body with flanged or grooved ends.
 - 1. Manufacturers:
 - a. Central Sprinkler Corp.
 - b. Crane Co.; Crane Valve Group; Crane Valves.
 - c. Crane Co.; Crane Valve Group; Jenkins Valves.
 - d. NIBCO.
 - e. Stockham.
 - D. Gate Valves: UL 262, OS&Y type.
 - 1. NPS 2 and Smaller: Bronze body with threaded ends.
 - a. Manufacturers:
 - 1) Crane Co.; Crane Valve Group; Crane Valves.
 - 2) NIBCO.
 - 3) United Brass Works, Inc.
 - 2. NPS 2-1/2 and Larger: Cast-iron body with flanged ends.
 - a. Manufacturers:
 - 1) Crane Co.; Crane Valve Group; Crane Valves.
 - 2) Crane Co.; Crane Valve Group; Jenkins Valves.
 - 3) Mueller Company.
 - 4) NIBCO.
 - E. Indicating Valves: UL 1091, with integral indicating device and ends matching connecting piping.
 - 1. Indicator: Electrical, 115-V ac, prewired, 2-circuit, supervisory switch.
 - 2. NPS 2 and Smaller: Ball or butterfly valve with bronze body and threaded ends.
 - a. Manufacturers:
 - 1) Milwaukee Valve Company.
 - 2) NIBCO.
 - 3) Victaulic Co. of America.
 - 3. NPS 2-1/2 and Larger: Butterfly valve with cast- or ductile-iron body; wafer type or with flanged or grooved ends.
 - a. Manufacturers:
 - 1) Central Sprinkler Corp.
 - 2) Grinnell Fire Protection.
 - 3) NIBCO.
 - 4) Victaulic Co. of America.
- 2.6 SPECIALTY VALVES
 - A. Sprinkler System Control Valves: UL listed or FMG approved, cast- or ductile-iron body with flanged or grooved ends, and 175-psig minimum pressure rating.
 - 1. Manufacturers:
 - a. Central Sprinkler Corp.
 - b. Grinnell Fire Protection.

- c. Victaulic Co. of America.
 - d. Viking Corp.
 - 2. Alarm Check Valves: UL 193, designed for horizontal or vertical installation, with bronze grooved seat with O-ring seals, single-hinge pin, and latch design. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, retarding chamber, and fill-line attachment with strainer.
 - a. Drip Cup Assembly: Pipe drain without valves and separate from main drain piping.
 - b. Drip Cup Assembly: Pipe drain with check valve to main drain piping.
 - B. Automatic Drain Valves: UL 1726, **NPS 3/4**, ball-check device with threaded ends.
 - 1. Manufacturers:
 - a. AFAC Inc.
 - b. Grinnell Fire Protection.
- 2.7 SPRINKLERS
- A. Sprinklers shall be UL listed or FMG approved, with **175-psig** minimum pressure rating.
 - B. Manufacturers:
 - 1. Central Sprinkler Corp.
 - 2. Grinnell Fire Protection.
 - 3. Victaulic Co. of America.
 - 4. Viking Corp.
 - C. Automatic Sprinklers: With heat-responsive element complying with the following:
 - 1. UL 1767, for early-suppression, fast-response applications.
 - D. Sprinkler Types and Categories: Nominal **1/2-inch** orifice for "Ordinary" temperature classification rating, unless otherwise indicated or required by application.
 - E. Sprinkler types, features, and options as follows:
 - 1. Concealed, flat, white trim – all finished spaces with ceilings.
 - 2. Rough brass uprights, - all unfinished spaces open to structure.
 - F. 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: White painted steel, 2 piece, with **1-inch** vertical adjustment.
 - G. Sprinkler Guards as needed in areas subject to mechanical damage: Wire-cage type, including fastening device for attaching to sprinkler.
- PART 3 - EXECUTION
- 3.1 PIPING APPLICATIONS, GENERAL
- A. Flanges, flanged fittings, unions, nipples, and transition and special fittings with finish and pressure ratings same as or higher than system's pressure rating may be used in aboveground applications, unless otherwise indicated.
- 3.2 SPRINKLER SYSTEM PIPING APPLICATIONS
- A. **NPS 1-1/2** and Smaller: Threaded-end, black galvanized, standard-weight steel pipe; cast-or malleable-iron threaded fittings; and threaded joints.
 - B. **NPS 1-1/2** and Smaller: Plain-end, black or galvanized, standard-weight steel pipe; locking-lug fittings; and twist-locked joints.
 - C. **NPS 2** and Larger: Threaded-end, black or galvanized, standard-weight steel pipe; cast-or malleable-iron threaded fittings; and threaded joints.
 - D. **NPS 2** and Larger: Grooved-end, black or galvanized, standard-weight steel pipe; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.
- 3.3 VALVE APPLICATIONS
- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 - 1. Listed Fire-Protection Valves: UL listed and FMG approved for applications where required by NFPA 13 and NFPA 14.
 - a. Shutoff Duty: Use butterfly or gate valves.
 - 2. Unlisted General-Duty Valves: For applications where UL-listed and FMG-approved valves are not required by NFPA 13 and NFPA 14.
 - a. Shutoff Duty: Use butterfly or gate valves.
 - b. Throttling Duty: Use globe valves.

3.4 JOINT CONSTRUCTION

- A. Refer to Division 21 Section "Common Work Results for Fire Suppression" for basic piping joint construction.
- B. Threaded Joints: Comply with NFPA 13 for pipe thickness and threads. Do not thread pipe smaller than NPS 8 (DN 200) with wall thickness less than Schedule 40 unless approved by authorities having jurisdiction and threads are checked by a ring gage and comply with ASME B1.20.1.
- C. Twist-Locked Joints: Insert plain-end piping into locking-lug fitting and rotate retainer lug one-quarter turn.
- D. Pressure-Sealed Joints: Use UL-listed tool and procedure. Include use of specific equipment, pressure-sealing tool, and accessories.
- E. Grooved Joints: Assemble joints with listed coupling and gasket, lubricant, and bolts.
 - 1. Ductile-Iron Pipe: Radius-cut-groove ends of piping. Use grooved-end fittings and grooved-end-pipe couplings.
 - 2. Steel Pipe: Square-cut or roll-groove piping as indicated. Use grooved-end fittings and rigid, grooved-end-pipe couplings, unless otherwise indicated.
 - 3. Dry-Pipe Systems: Use fittings and gaskets listed for dry-pipe service.

3.5 PIPING INSTALLATION

- A. Refer to Division 21 Section "Common Work Results for Fire Suppression" for basic piping installation.
- B. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.
 - 1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Engineer before deviating from approved working plans.
- C. Use approved fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- D. Install unions adjacent to each valve in pipes **NPS 2** and smaller. Unions are not required on flanged devices or in piping installations using grooved joints.
- E. Install flanges or flange adapters on valves, apparatus, and equipment having **NPS 2-1/2** and larger connections.
- F. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, sized and located according to NFPA 13.
- G. Install sprinkler piping with drains for complete system drainage.
- H. Hangers and Supports: Comply with NFPA 13 for hanger materials.
 - 1. Install standpipe system piping according to NFPA 14.
 - 2. Install sprinkler system piping according to NFPA 13.
- I. Earthquake Protection: Install piping according to NFPA 13 to protect from earthquake damage.
- J. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than **NPS 1/4** and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.
- K. Fill wet-pipe sprinkler system piping with water.

3.6 VALVE INSTALLATION

- A. Install listed fire-protection valves, unlisted general-duty valves, specialty valves and trim, controls, and specialties according to NFPA 13 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. Alarm Check Valves: Install in vertical position for proper direction of flow, including bypass check valve and retarding chamber drain-line connection.

3.7 SPRINKLER APPLICATIONS

- A. Where specific types are not indicated, use the following sprinkler types:
 - 1. Rooms without Ceilings: Upright sprinklers.

2. Rooms with Suspended Ceilings: Recessed sprinklers.
3. Wall Mounting: Sidewall sprinklers.
4. Sprinkler Finishes:
 - a. White finish – sprinkler and trim.

3.8 SPRINKLER SYSTEM TANKS (AS REQUIRED IN THE FUTURE – SEE DRAWINGS)

**NOTE: INFORMATION IS FOR PLANNING PURPOSES FOR FUTURE INSTALLATION.
TANK(S) ARE NOT BEING INSTALLED AT THIS TIME AS PART OF THIS PROJECT.**

Single-wall Aboveground Horizontal

Single-wall Steel Storage Tank:

Furnish and install an aboveground, horizontal, single-wall, steel storage tank. The tank shall be in conformance with the Underwriters Laboratories' UL-142 specifications and so labeled. Tank size will be noted on an attached reference drawing.

or

Furnish and install a 35,000 gallon aboveground, horizontal, single-wall, steel storage tank 12'0" inches in diameter by 47'6" long. Tank shall be fabricated from mild carbon steel with flat-flanged heads. Tank gauges: head gauge 3/8, shell gauge 3/8. All items included with the tank shall be coated with red primer. The tank shall be manufactured in conformance with Underwriters Laboratories' UL-142 specifications and so labeled.

The tank shall be fabricated with flanged, or threaded connections as shown on the drawing and as required - 150# flanged connections with flange protectors (where shown and required). Thread protectors shall be inserted in all threaded openings prior to shipment.

Highland tanks are air tested at the factory but MUST be retested at the jobsite by the installer prior to installation.

Options & Accessories (See Drawings):

- _____ Manway(s) _____ inches in diameter with bolted and gasketed lid
- _____ Loose-bolt Manway _____ inches in diameter with bolted and gasketed lid (emergency vent)
- _____ Support Saddles per drawing
- _____ Emergency Vent
- _____ External Ladder
- _____ External Ladder & Platform
- _____ External Stairway
- _____ Pump Platform
- _____ Walkway(s) with Handrails
- _____ Commercial grit blast (SSPC-6), epoxy primer coat
- _____ Exterior polyurethane paint _____
- _____ Other exterior coating _____
- _____ Internal Ladder(s)
- _____ Internal coating _____ (Must include interior weld. Minimum size 500 gallon.)
- _____ Level Sensing System(s)
- _____ Overfill Containment Chamber

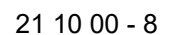
Warranty:

The subject tank is warranted by Highland Tank & Mfg. Co. to be free from defects in manufacturing, workmanship and materials. Highland Tank will repair or replace, at its sole discretion F.O.B. factory, within a period of one year after date of shipment, any item of our manufacture. All other items shall be warranted by their respective manufacturers. Liability hereunder is limited, as stated above, and does not

include labor, installation costs, indirect or consequential damages of any kind. Tanks must be returned to the factory and if found to be defective upon examination, will be repaired, replaced or credit will be issued at our option.

Approved Manufacturer:

Tank to be manufactured by Highland Tank or approved equivalent.



3.9 SPRINKLER INSTALLATION

- A. Install sprinklers in suspended ceilings in center of acoustical ceiling panels and tiles.
- B. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing. Use dry-type sprinklers with water supply from heated space.

3.10 LABELING AND IDENTIFICATION

- A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13 and NFPA 14.

3.11 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
 - 3. Flush, test, and inspect standpipe systems according to NFPA 14, "System Acceptance" Chapter.
 - 4. Coordinate with fire alarm tests. Operate as required.
 - 5. Verify that equipment hose threads are same as local fire department equipment.
- B. Report test results promptly and in writing to Engineer and authorities having jurisdiction.

END OF SECTION 211000

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SECTION 22 00 80 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for Project Record Documents, including the following:
 - 1. Record Drawings.
 - 2. Record Specifications.
- B. See Division 22 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
- C. See Division 22 Sections for specific requirements for Project Record Documents of the Work in those Sections.

1.2 SUBMITTALS

- A. Record Drawings: Comply with the following:
 - 1. Number of Copies: Submit one set of marked-up Record Prints.
- B. Record Specifications: Submit one copy of Project's Specifications, including addenda and contract modifications.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

- A. Record Prints: Maintain one set of blue- or black-line white prints of the Contract Drawings and Shop Drawings.
 - 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. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
 - c. Indicate dimensions to locate underground and concealed lines from fixed reference points.
 - d. Indicate burial depth for underground lines.
 - 2. Mark the Contract Drawings completely and accurately.
 - 3. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
 - 4. Note Addendum numbers, Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Format: Identify and date each Record Drawing; include the designation "AS-BUILT MARKED PRINT" in a prominent location.
 - 1. Record Prints: Organize Record Prints and newly prepared Record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
 - 2. Identification: As follows:
 - a. Project name.
 - b. Date.
 - c. Designation "AS-BUILT MARKED PRINTS."
 - d. Name of Architect.
 - e. Name of Contractor.

2.2 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
 - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 - 2. Note related Change Orders and Record Drawings where applicable.

2.3 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.

2.4 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

PART 3 - EXECUTION

3.1 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 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 Architect's reference during normal working hours.

END OF SECTION

SECTION 22 01 00 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes through-penetration firestop systems for penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items.

1.2 PERFORMANCE REQUIREMENTS

- A. General: For penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.
- B. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per ASTM E 814 or UL 1479:
 - 1. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.
 - 2. T-Rated Systems: For the following conditions, provide through-penetration firestop systems with T-ratings indicated, as well as F-ratings, where systems protect penetrating items exposed to potential contact with adjacent materials in occupiable floor areas:
 - a. Penetrations located outside wall cavities.
 - b. Penetrations located outside fire-resistance-rated shaft enclosures.
- C. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.
 - 1. For floor penetrations with annular spaces exceeding 4 inches in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved, either by installing floor plates or by other means.
- D. For through-penetration firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For each through-penetration firestop system, submit documentation, including illustrations, from a qualified testing and inspecting agency, showing each type of construction condition penetrated, relationships to adjoining construction, and type of penetrating item.
 - 1. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular through-penetration firestop condition, submit illustration, with modifications marked, approved by through-penetration firestop system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.
- C. Qualification Data: For Installer.

1.4 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Provide through-penetration firestop systems that comply with the following requirements and those specified in Part 1 "Performance Requirements" Article:

1. Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL, or another agency performing testing and follow-up inspection services for firestop systems acceptable to authorities having jurisdiction.
 2. Through-penetration firestop systems are identical to those tested per testing standard referenced in "Part 1 Performance Requirements" Article. Provide rated systems bearing classification marking of qualified testing and inspecting agency.
- B. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.
- C. Do not cover up through-penetration firestop system installations that will become concealed behind other construction until each installation has been examined by Owner's inspecting agency and building inspector, if required by authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the through-penetration firestop systems indicated for each application on Drawings or that are produced by one of the following manufacturers:
1. Grace, W. R. & Co. - Conn.
 2. Hilti, Inc.
 3. Johns Manville.
 4. Nelson Firestop Products.
 5. 3M; Fire Protection Products Division.
 6. Tremco; Sealant/Weatherproofing Division.
 7. USG Corporation.

2.2 FIRESTOPPING

- A. Compatibility: Provide through-penetration firestop systems that are compatible with one another; with the substrates forming openings; and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.
- B. Accessories: Provide components for each through-penetration firestop system that are needed to install fill materials and to comply with Part 1 "Performance Requirements" Article. Use only components specified by through-penetration firestop system manufacturer and approved by qualified testing and inspecting agency for firestop systems indicated.

PART 3 - EXECUTION

3.1 THROUGH-PENETRATION FIRESTOP SYSTEM INSTALLATION

- A. General: Install through-penetration firestop systems to comply with Part 1 "Performance Requirements" Article and with firestop system manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. Install forming/damming/backing materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.
- C. Install fill materials for firestop systems by proven techniques to produce the following results:
 1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
 3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.2 FIELD QUALITY CONTROL

- A. Where deficiencies are found, repair or replace through-penetration firestop systems so they comply with requirements.
- B. Proceed with enclosing through-penetration firestop systems with other construction only after inspection reports are issued and firestop installations comply with requirements.

END OF SECTION

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SECTION 22 05 00 - COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. General provisions.
 - 2. Scope.
 - 3. Permits and Fees.
 - 4. Visit to Job Site.
 - 5. Workmanship.
 - 6. Drawings and Specifications.
 - 7. Tests.
 - 8. Allowance for added work.
 - 9. Incidental construction work.
 - 10. Access Doors
 - 11. Supervision.
 - 12. Electrical work by others.
 - 13. Existing facilities, utilities, etc.
 - 14. Adaptation of work to existing conditions.
 - 15. Submittal procedures.
 - 16. Product requirements.
 - 17. Closeout procedures.
 - 18. Operation and Maintenance Manuals.
 - 19. As-built Documents.
 - 20. Demonstration and Training.
 - 21. Warranty.
 - 22. Commissioning Support

PART 2 - NOT APPLICABLE

PART 3 - EXECUTION

3.1 GENERAL PROVISIONS

- A. This Contractor's attention is directed to the requirements of Instructions to Bidders, General Conditions and Supplementary General Conditions as bound in the specifications which apply in full to the plumbing work.
- B. Where the requirements of this Division conflict with other articles in these Specifications, the Contractor shall utilize the more stringent method.

3.2 SCOPE

- A. Provide all labor, materials, tools, equipment, and transportation, and perform all operations necessary for and reasonably incidental to proper execution and completion of all "Plumbing" work, whether specifically mentioned or not, all as indicated, specified herein, and/or implied thereby to carry out the apparent intent thereof.
- B. These drawings may be superseded by later revised or detailed drawings, specifications, or sketches prepared by the Designer, as needed for clarification, and this Contractor shall conform to all reasonable coordination requests.
- C. All items not specifically mentioned in the specifications or noted on the drawings, but which obviously are required to make the working installation complete, shall be included automatically.
- D. For projects which are bid or awarded as Single Prime contracts, organization of the Specifications into divisions, sections, and articles, and arrangement of the Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be done by any trade, unless specifically shown or noted otherwise.

3.3 PERMITS AND FEES

- A. This Contractor shall secure all permits required for the completion of this contract. He shall obtain and deliver to the Owner all certificates of inspection issued by the authorities having jurisdiction.

3.4 VISIT TO JOB SITE

- A. Before submitting a bid, this Contractor shall visit the job site for the purpose of thoroughly examining the site and conditions under which the work must be performed.

- B. The submission of a bona fide bid will be construed to mean that this Contractor understands and is satisfied with conditions under which the contract must be fulfilled.
- C. No extra compensation will be allowed for situations arising from failure of this Contractor to be thoroughly familiar with site conditions, including charges and requirements for connection to utilities as shown for this project.

3.5 WORKMANSHIP

- A. Workmanship in the fabrication, preparation, and installation of materials and equipment shall conform to the best standards of practice of the trades involved.
- B. Work shall be performed by experienced and skilled mechanics under the supervision of a competent foreman.
- C. Substandard workmanship will be cause for rejection of work and replacement by Contractor.
- D. The Contractor shall reimburse the Designer for all costs incurred by the Designer due to Contractor's substandard or non-conforming work.

3.6 DRAWINGS AND SPECIFICATIONS

- A. The drawings show the location and arrangement of fixtures, piping, and equipment, together with details of connections of certain principal items.
- B. The layout shown shall be followed as closely as circumstances will permit, but this Contractor shall lay out his work so as to avoid conflict with other Contractors and trades, and to avoid any unnecessary cutting or damage to walls, floors, and supporting structural members.
- C. This Contractor shall carefully and accurately locate all sleeves and install at the proper time all necessary hangers, inserts, etc., which will be required for the completion of his work, and shall be solely responsible for the accurate and proper location of above items.
- D. This Contractor shall refer to architectural, mechanical, and electrical drawings and shall cooperate fully with other Contractors and trades while installing piping, fixtures, and other equipment because of close space limits.
 - 1. In case of conflict, notify Designer before proceeding with installation.
 - 2. Refer to architectural drawings for exact building dimensions and location of partition walls, doors, chases, etc.
 - 3. Plumbing drawings are not to be scaled for such dimensions.
- E. The drawings and specifications complement each other and together are intended to give a complete description of the work.
 - 1. Any item of equipment or note of work to be done as shown on plans and not mentioned in the specifications, or mentioned in specifications and not shown in plans, shall be furnished the same as if mentioned or shown in both places.
 - 2. If conflicts exist, then the most stringent method shown or described shall apply.
- F. Any switches, controls, or equipment included in this contract work (drawings and/or specifications) that are not specifically shown on drawings shall be located for convenient use and access.
- G. Contractor shall coordinate all equipment arrangement and lay-out in field prior to beginning any actual installation of his work.
- H. If Contractor notes any discrepancy, omission, or conflict found in plans or specifications, he shall call to the immediate attention of the Designer, prior to receipt of bids.
- I. It is the intention that piping, air ducts and light fixtures are designed and laid out to clear each other.
 - 1. It shall be the responsibility of this Contractor to coordinate his work with that of other trades to avoid any such conflicts.
 - 2. Any conflicts that occur after work of one trade is installed and was not prior coordinated shall be relocated or rearranged at the total expense of this Contractor, as directed by Designer.
 - 3. Any conflicts that cannot be corrected in field by relocation or elevation changes shall be reported to the Designer in writing prior to any installation.
- J. The drawings are not intended to show each and every complete or accurate detail.
 - 1. The figures and writing on drawings shall be taken instead of scaling.

2. It is this Contractor's responsibility to comply with the evident intent for centering and symmetric arrangement.
 3. This Contractor shall take and be responsible for all field measurements.
 4. Exact locations and relations are to be defined in the field and shall be satisfactory to the Designer.
- K. Because of the small scale of plumbing drawings it is not possible to indicate all offsets, fittings, and accessories which may be required.
1. Investigate structural and finish conditions affecting this work and arrange work accordingly, providing such fittings and accessories that may be required to meet the conditions.

3.7 TESTS

- A. The Designer reserves the right to conduct acceptance tests of all equipment, piping, or any other work furnished under these specifications to determine the fulfillment of special requirements.
1. Such tests shall be conducted in the presence of authorized representatives of the Contractor, Owner, Engineer, and Architect at such time as the Designer may designate.
 2. This Contractor shall perform all tests, bear cost of same and make adjustments of equipment and wiring as may be deemed necessary by the Designer.

3.8 ALLOWANCE FOR ADDED WORK

- A. Before proceeding with any work for which compensation may be claimed or the Owner may claim credit, a detailed estimate shall first be submitted and approved in writing.
1. No claim for addition to the contract sum will be valid unless so ordered and approved by the Owner and Designer, prior to start of work.
 2. Any conflicts corrected by relocation or elevation changes do not constitute extra work.

3.9 INCIDENTAL CONSTRUCTION WORK

- A. All blocking for openings for piping in concrete floors, masonry walls or partitions shall be provided by this Contractor.
1. This Contractor shall do all cutting and fitting of his work and of other work that may be required to make the several parts come together properly and to fit his work to receive or be received by the work of other Contractors as shown upon, or reasonably implied by the drawings and specifications.
 2. He shall properly complete and finish up his work after other Contractors have finished as the Designer may direct.
- B. All excavating required for the installation of this system shall be done by this Contractor.
1. Backfill shall be accomplished as specified in appropriate section of specifications.
- C. Chases are prohibited in masonry walls which are not to be plastered or paneled.
1. Set piping, blocking, carriers, etc. indicated to be concealed before walls are constructed in order that walls may be constructed around them.
 2. This Contractor shall furnish all sleeves in floors, beams, walls, etc., for each such penetration as needed for installing his work and installation of sleeves by Contractor.
- D. Unless otherwise noted, the Contractor will provide openings and lintels as new construction progresses, but this Contractor shall fully designate his requirements prior to construction.
1. Failure to furnish his requirements prior to building construction and failure to coordinate his work with the building construction shall make this Contractor responsible for removing, replacing and painting building construction as required for installation of his work.

3.10 ACCESS DOORS

- A. Provide and install access doors in walls, ceilings, etc. as required for access to valves and other devices requiring access in ceilings, chases, soffits, etc.
- B. Access doors in non-fire rated walls or ceilings shall be as follows:
1. Nominal 24" x 24" minimum size.
 2. 16-gage steel frame with 14-gage door panel and galvanized steel drywall bead.
 3. Flush style with provision to conceal flange with drywall cement.
 4. Double-acting concealed spring hinges to allow opening to 175 degrees.
 5. Flush, Allen-head operated with steel cam.
 6. Gray prime-painted steel, for painting to match adjacent finished surfaces.
 7. Basis of Design: Milcor Style DW; Comparable Products by Karp, Elmdor, Acudor.

- C. Access doors in fire-rated walls or ceilings shall be as follows:
 - 1. Nominal 24" x 24" minimum size.
 - 2. UL 1-1/2 hour, Class B fire rating.
 - 3. Prime-painted stainless steel: 16-gage frame with 20-gage door panel, for painting to match adjacent finished surfaces.
 - 4. 2" mineral fiber insulation between inner and outer panel.
 - 5. Continuous hinge, steel with stainless steel pin.
 - 6. Self-closing and self-latching panel closer.
 - 7. Flush mounted paddle latch and locking system with flush, key-operated cylinder lock with two keys.
 - 8. Basis of Design: Milcor Style UFR; Comparable Products by Karp, Elmdor, Acudor.

3.11 SUPERVISION

- A. This Contractor shall have in charge of the work at all times during construction a thoroughly competent foreman with extensive experience in the work to be performed under this contract.
 - 1. Anyone deemed not capable by the Designer shall be replaced immediately upon request, and after satisfactory foreman has been assigned, he shall not be withdrawn without the written consent of the Designer.

3.12 ELECTRICAL WORK BY OTHERS

- A. Refer to the drawings for the details of locations of circuit breakers, junction boxes, disconnect switches, conduits and slack wire required where this contractor's electrical work terminates and electrical work by others begins.
- B. The Electrical Contractor shall furnish and install all power circuits for equipment furnished by others.
- C. In Mechanical Rooms the wiring by the Electrical Contractor shall generally terminate in a power wiring gutter, line side of disconnect switches or starters, junction box, or electrical panel.
 - 1. From these points power wiring to the equipment furnished by the Plumbing Contractor shall generally be by the Plumbing Contractor.
 - 2. Power wiring to mechanical equipment outside equipment rooms will generally be run by the Electrical Contractor to line side of a disconnect switch or junction box in the vicinity (within 3'-0") of the plumbing equipment.
 - 3. Power wiring from that point to the equipment will be by the Plumbing Contractor.
- D. Plumbing Contractor is to refer to the drawings for location and type of service connections to be provided under the electrical contract.
 - 1. Where service disconnect switches are required and not furnished as part of the equipment, they shall be furnished and installed by contractor that furnishes the equipment, unless indicated otherwise.
 - 2. Other Contractors shall furnish and install conduit, boxes, wiring and all items of control for equipment they furnish or Owner furnished equipment, unless specifically shown on electrical drawings.

3.13 EXISTING FACILITIES

- A. In existing facilities, disruption of operations must be kept to a minimum and coordinated with Owner.
 - 1. Work in existing buildings must be cleaned up daily immediately after finishing that portion of work and equipment left in order for Owner to continue operations.
 - 2. When it is necessary to interrupt utility services in the fulfillment of this contract, such interruptions shall be kept to a minimum and coordinated with Owner.
 - 3. Once work has begun, it shall be pursued diligently until completed.
- B. Every precaution shall be taken to prevent damage to existing underground lines and structures and public utilities.
 - 1. Damage to existing water and sewer lines, culverts, service connections, underground cables, and similar surface and sub-surface structures shall be at the risk of this Contractor, whether or not locations thereof are shown on plans, and the repairing of such damage shall be by this Contractor and shall be completed without delay.
 - 2. Compensation for such repairs shall be based on normal and reasonable costs.

- C. The locations of any existing underground utilities that are shown are in an approximate way only and have not been independently verified by the Owner or its representative.
 - 1. The Contractor shall determine the exact location of all existing utilities before commencing work, and agrees to be fully responsible for any and all damages which might be occasioned by the Contractor's failure to exactly locate and preserve any and all underground utilities.

3.14 ADAPTATION OF WORK TO EXISTING CONDITIONS

- A. It is reasonably implied that this Contractor shall furnish all labor and materials to provide Owner with a new and satisfactory system in these facilities.
 - 1. Contractor is to include necessary work for adaptation of equipment to conditions that may be found to produce conflicts during construction.
 - 2. When any such conditions are encountered, this Contractor is to consult with Designer and then modify installation as directed without additional costs, and to include any incidental materials required.

3.15 SUBMITTAL PROCEDURES

- A. Coordinate preparation and processing of submittals with performance of construction activities.
 - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 - 2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
 - 3. Designer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- B. Contractor approval: Affix review stamp to cover sheet, with initials and date of Contractor's approval of submittals.
 - 1. By submitting Shop Drawings, Product Data, Samples and similar submittals, this Contractor represents that the Contractor has determined and verified materials, field measurements and field construction criteria and details related thereto, or will do so, and has checked and coordinated the information contained within such submittals with the requirements of the Work, the Contract Documents and the Work of other trades.
- C. Comply with requirements in Division 01 Sections for list of submittals and time requirements for scheduled performance of related construction activities.
- D. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows.
 - 1. Time for review shall commence on Designer's receipt of submittal.
 - 2. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
 - 3. Allow 21 days for initial review of each submittal.
 - a. Allow additional time if coordination with subsequent submittals is required.
 - b. Designer will advise Contractor when a submittal being processed must be delayed for coordination.
 - 4. Allow 15 days for review of each resubmittal.
- E. Identification: Identify submittals as required in Division 01 sections.
- F. Deviations: Highlight, encircle, or otherwise specifically identify deviations from the Contract Documents on submittals.
 - 1. Summarize deviations on transmittal or List of Deviations included with submittal.
- H. Transmittal: Package each submittal individually and appropriately for transmittal and handling.
 - 1. Transmit each submittal using a transmittal form.
 - 2. Designer will discard submittals received from sources other than Contractor.
- I. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
 - 1. Note date and content of previous submittal.
 - 2. Note date and content of revision in label or title block and clearly indicate extent of revision.
 - 3. Resubmit submittals until they are marked "Furnish as Submitted" or "Furnish as Corrected."
 - 4. Where submittals contain specific questions or comments, provide a separate sheet with specific answers to each question or comment.

- J. At Contractor's written request, copies of Designer's CAD files will be provided to Contractor for Contractor's use in connection with Project, subject to the following conditions:
 - 1. Allow 21 days from Designer's receipt of written request for CAD files for delivery of files
 - 2. Files will be delivered via email or compact disc.
 - 3. Files will be delivered without RN&M Title Blocks, standard details, schedules, etc.
 - 4. CAD files provided for Contractor's use are not to be construed as the Contract Documents. Use of CAD files for submittals or other uses are at the Contractor's risk.
- K. Prepare and submit Action Submittals required by individual Specification Sections.
 - 1. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
 - 2. Number of Copies: Submit at least eight copies of Product Data, unless otherwise indicated.
 - a. Designer will return all but three copies.
 - b. Retain or duplicate sufficient copies for inclusion in Operation and Maintenance Manuals.
 - 3. Shop Drawings: Prepare Project-specific information, drawn accurately to scale.
 - a. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data, unless submittal of Designer's CAD Drawings is otherwise permitted.
 - 5. Sheet Size: At least 8-1/2 by 11 inches but no larger than size of project drawings.
 - 7. Number of Copies: Two opaque (bond) copies of each submittal. Designer will return one copy.
 - 8. Manufacturers and Materials Suppliers List: Submit three copies of manufacturers and materials suppliers list within 20 days of Contract Award, unless otherwise indicated. Designer will return two copies.
 - 10. Subcontract List: Submit within 20 days of Contract Award three copies of list of proposed subcontractors. Designer will return two copies. Subcontract list to include all tiers of subcontractors.
- L. Contractor's Review and Approval: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents.
 - 1. Note corrections and field dimensions.
 - 2. Mark with approval stamp before submitting to Designer.
- M. Designer's Action: Designer will not review submittals that do not bear Contractor's approval stamp and will return them without action.
 - 1. Designer will review each submittal, make marks to indicate corrections or modifications required, and return it.
 - 2. Designer will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken, as follows:
 - a. Furnish as Submitted
 - b. Furnish as Corrected: Incorporate comments marked on or attached to submittal.
 - c. Revise and Resubmit: Major items of the submittal do not comply, requiring a resubmittal.
- N. Partial submittals are not acceptable, will be considered nonresponsive, and will be returned without review.
- O. Submittals not required by the Contract Documents may not be reviewed and may be discarded.
- P. The Contractor is responsible for compliance with the Contract Documents, dimensions, details, coordination, and satisfactory performance of materials and equipment provided and installed.

3.16 PRODUCT REQUIREMENTS

- A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - 1. Basis-of-Design Product: Item identified by manufacturer's product name, make, and model number, used to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, dimensions, and other characteristics for purposes of evaluating comparable products of other named manufacturers.

2. Comparable Product: Product that is listed in the Contract Documents, or added by Addendum, and demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified or basis-of-design product.
 3. Owner-preferred Alternate Product: Product that is listed in the Contract Documents, and for which an Alternate Bid price is submitted. When an Alternate Bid item is accepted in the Contract, no substitutions will be allowed.
 4. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor after award of Contract.
 5. New Products: Items that have not previously been incorporated into another project or facility, except that products consisting of recycled-content materials are allowed, unless explicitly stated otherwise. Products salvaged or recycled from other projects are not considered new products.
- B. Comparable Product Requests: Submit three copies of each request for consideration, at least 10 days prior to receipt of bids, for products not listed in the Contract Documents. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
1. Documentation: Show compliance with requirements for Comparable Products and the following, as applicable:
 - a. 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 product.
 - b. Detailed comparison of significant qualities of proposed product 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.
 - c. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 2. Designer's Action: If necessary, Designer will request additional information or documentation for evaluation. Designer will notify Contractor of approval or rejection of proposed comparable product request.
 - a. Form of Approval: Addition of the item to the list of Comparable Products by Addendum, prior to receipt of bids.
 - b. Use product specified if Designer cannot make a decision on use of a comparable product request within time allocated.
- C. 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.
1. Provide products complete with accessories, trim, finish, fasteners, features, options, and other items needed for a complete installation and indicated use and effect, and as required or recommended by the manufacturer for a complete installation, whether or not specifically indicated on the drawings or specifications.
 2. 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.
 3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
 4. Where products are accompanied by the term "as selected," Designer will make selection.
 5. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.
- D. Product Selection Procedures:
1. Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed that complies with requirements.

2. Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.
3. Basis-of-Design Product: Where Specifications name a product and include a list of manufacturers, provide the specified product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named.
- E. Responsibility of the Contractor: The responsibility for determining dimensions, utility requirements, fitting of work with other trades, sequencing and coordination of work, for Product Substitutions and Comparable Products rests solely with the Contractor.
- F. Manufacturer's Warranties: Where specifications require manufacturer's warranties, the provisions of the Contract Documents take precedence over any manufacturer's "standard" warranty provisions, exclusions, etc.
 1. The start of manufacturer's warranties shall be the date of Substantial Completion of the project or phase of the project, notwithstanding any language or exclusion in any document submitted by the contractor or manufacturer.

3.17 CLOSEOUT PROCEDURES

- A. Substantial Completion: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.
 1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
 2. Complete startup testing of systems.
 3. Submit test records.
 4. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
 5. Complete final cleaning requirements, including touchup painting.
 6. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
 7. Submit a written request for inspection for Substantial Completion. On receipt of request, Designer will either proceed with inspection or notify Contractor of unfulfilled requirements.
 8. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
 9. Results of completed inspection will form the basis of requirements for Final Completion.
- B. Final Completion: Before requesting final inspection for determining date of Final Completion, complete the following:
 1. Submit certified copy of Designer's Substantial Completion inspection list of items to be completed or corrected (punch list). The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 2. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit documentation of training.
 3. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Designer will either proceed with inspection or notify Contractor of unfulfilled requirements.
 4. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
- C. Cleaning: This Contractor shall provide all systems and equipment in a new and clean condition.
 1. Clean all items furnished and installed in accordance with manufacturer's recommendations.
 2. Provide instruction to Owner in proper cleaning of all items provided as part of this Division.
 3. Cooperate with CMAR in cleaning of building.

3.18 OPERATION AND MAINTENANCE MANUALS

- A. Submit four complete copies of Operation and Maintenance Manuals to Designer for review prior to request for inspection for Substantial Completion.
- B. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain a title page, table of contents, and manual contents.

- C. Title Page: Enclose title page in transparent plastic sleeve. Include the following information:
 - 1. Subject matter included in manual.
 - 2. Name and address of Project.
 - 3. Name and address of Owner.
 - 4. Date of submittal.
 - 5. Name, address, and telephone number of Contractor.
 - 6. Name and address of Architect.
 - 7. Name and address of Engineer.
- D. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
- E. List of Material Suppliers and Subcontractors: List contact information for each material supplier and subcontractor.
- F. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
 - 1. Binders: Heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
 - a. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.
 - 2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
 - 3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.
 - 4. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
 - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
 - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.
- G. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.
- H. Descriptions: Include the following: Product name and model number, Manufacturer's name, Equipment identification with serial number of each component, Equipment function, Operating characteristics, Limiting conditions, Performance curves, Engineering data and tests, Complete nomenclature and number of replacement parts.
- I. Include start-up, break-in, and control procedures; stopping and normal shutdown instructions; routine, normal, seasonal, and weekend operating instructions; and required sequences for electric or electronic systems.
- J. Describe the sequence of operation, and diagram controls as installed.
- K. List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.
- L. Provide manufacturers' maintenance documentation including maintenance instructions, drawings and diagrams for maintenance, nomenclature of parts and components, and recommended spare parts for each component part or piece of equipment:

- M. Include test and inspection instructions, troubleshooting guide, disassembly instructions, and adjusting instructions that detail essential maintenance procedures:
- N. Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
- O. Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- P. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
- Q. Provide complete approved submittal data with all annotations.
- R. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in Record Drawings to ensure correct illustration of completed installation.

3.19 AS-BUILT DOCUMENTS

- A. As-built Marked Prints: Maintain one set of blue- or black-line white prints of the Contract Drawings.
 - 1. Mark Record Prints to show the actual installation where installation varies from that shown originally.
 - 2. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up As-built Marked Prints.
 - 3. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - 4. Record data as soon as possible after installation.
 - 5. Record and check the markup before enclosing concealed installations.
 - 6. Indicate dimensions to locate underground and concealed conduits and lines from fixed reference points.
 - 7. Indicate burial depth for underground lines.
 - 8. Indicate location of all valves and cross-reference to valve tag list.
 - 9. Mark the Contract Drawings completely and accurately.
 - a. Mark record sets with erasable, red-colored pencil.
 - b. Note Addendum numbers, Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
 - 10. Maintain As-built Marked Prints in a clean, legible, up-to-date condition in the project office, and available to the Designer for inspection upon request throughout construction.
- B. Record Specifications: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
 - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 - 2. Note related Change Orders and As-built Marked Prints where applicable.

3.20 DEMONSTRATION AND TRAINING

- A. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
- B. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season. Schedule training with Owner with at least seven days' advance notice.
- C. Warranty service: Train Owner in repair and troubleshooting during each warranty service call.
- D. For each training session, submit on letterhead name of trainer, date of training, names of Owner's personnel trained, and systems/equipment trained on.
- E. For factory training, documentation to be on letterhead of organization conducting training.

3.21 WARRANTY

- A. This Contractor shall guarantee all materials, equipment, workmanship and each and every piece of apparatus which he furnished and which he installs under this contract against defects and failures of any nature for a period of one year from date on which the system is accepted.

- B. Apparatus furnished by this Contractor shall be guaranteed to be satisfactory when operated under rated conditions in accordance with manufacturer's instructions and to be of size, function, and capacity specified on drawings or in the specifications.
- C. Equipment manufacturers shall warrant equipment furnished for this project for same time span as installing contractors warranty period as set above and elsewhere in these specifications.
 - 1. Warranty start date shall be as established by the Designer. Refer to General Conditions, Supplementary General Conditions, and Division 1 specifications for establishment of warranty start dates.
 - 2. The provisions of the Contract Documents supersede and override any manufacturer's standard warranty provisions.
- D. Upon notice from the Designer or Owner, Contractor shall immediately check system, make necessary repairs or adjustments as required; due to faulty workmanship, materials, faults, operation or equipment, without cost to the Owner, and instruct Owner in proper operation, adjustment, and care of systems.
- E. During the one-year warranty period, the Contractor shall be responsible for all preventive maintenance, including routine lubrication, filter changing, inspections, and adjustments.
 - 1. Contractor shall provide all materials, consumables, equipment, supplies, etc. required for preventive maintenance.
 - 2. Perform preventive maintenance in accordance with manufacturer's recommendations.
 - 3. During preventive maintenance, instruct Owner in proper preventive maintenance procedures.
- F. The Contractor shall submit service call tickets, reports, or other documentation of each warranty service call to the Designer.

3.22 COMMISSIONING SUPPORT

- A. This contractor shall support all Commissioning as requested by the Commissioning Agent, to include but not limited to the following:
 - 1. Performance tests
 - 2. Piping tests as requested
 - 3. Factory startup of equipment
 - 4. Any commissioning activity, as requested by the Commissioning Agent.

END OF SECTION

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SECTION 22 05 13 - COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.2 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 requirements in this Section except when stricter requirements are specified in plumbing equipment schedules or Sections.
- B. Comply with NEMA MG 1 unless otherwise indicated.

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: Energy efficient, as defined in NEMA MG 1.
- C. Service Factor: 1.15.
- D. Rotor: Random-wound, squirrel cage.
- E. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- F. Temperature Rise: Match insulation rating.
- G. Insulation: **Class F**

- H. Code Letter Designation:
 - 1. Motors Smaller than **15 HP**: Manufacturer's standard starting characteristic.
- I. Enclosure Material: Cast iron for motor frame sizes **324T** and larger; rolled steel for motor frame sizes smaller than **324T**.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

- 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. Energy- and 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.

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 16 - EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Metal-bellows expansion joints.
 - 2. Pipe bends and loops.
 - 3. Alignment guides and anchors.
 - 4. Analysis by Professional Engineer for any Seismic joint which will be required for the seismic category as noted on the Architectural Drawings.

1.2 SUBMITTALS

- A. Calculations for Seismic joints at building joints.
- B. Product Data: For each type of product indicated.
- C. Delegated-Design Submittal: For each anchor and alignment guide 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. Design Calculations: Calculate requirements for thermal expansion of piping systems and for selecting and designing expansion joints, loops, and bends.
 - 2. Anchor Details: Detail fabrication of each anchor indicated. Show dimensions and methods of assembly and attachment to building structure.
 - 3. Alignment Guide Details: Detail field assembly and attachment to building structure.
 - 4. Schedule: Indicate type, manufacturer's number, size, material, pressure rating, end connections, and location for each expansion joint.
- D. Welding certificates.
- E. Product certificates.
- F. Maintenance data.

1.3 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. Steel Shapes and Plates: AWS D1.1, "Structural Welding Code - Steel."
 - 2. Welding to Piping: ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.1 EXPANSION JOINTS

- A. Metal-Bellows Expansion Joints: ASTM F 1120, circular-corrugated-bellows type with external tie rods.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:
 - a. Adscos Manufacturing, LLC.
 - b. Flex-Hose Co., Inc.
 - c. Metraflex, Inc.
 - d. Piping Technology & Products, Inc.
 - e. Senior Flexonics, Inc.; Pathway Division.
 - 2. Metal-Bellows Expansion Joints for Copper Piping: Single-ply phosphor-bronze bellows, copper pipe end connections, and brass shrouds.
 - 3. Metal-Bellows Expansion Joints for Stainless-Steel Waterway: Single-ply stainless-steel bellows, stainless-steel-pipe end connections, and steel shroud.
 - 4. Metal-Bellows Expansion Joints for Steel Piping Single-ply stainless-steel bellows, steel pipe end connections, and carbon-steel shroud.
 - 5. Minimum Pressure Rating: 175 psig unless otherwise indicated.
 - 6. Configuration Single bellows type, unless otherwise indicated.
 - 7. End Connections: Flanged or threaded

2.2 ALIGNMENT GUIDES

- A. Description: Steel, factory fabricated, with bolted two-section outer cylinder and base for alignment of piping and two-section guiding spider for bolting to pipe.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:
 - a. Adscos Manufacturing, LLC.
 - b. Flex-Hose Co., Inc.

- c. Metraflex, Inc.
- d. Piping Technology & Products, Inc.
- e. Senior Flexonics, Inc.; Pathway Division.

2.3 MATERIALS FOR ANCHORS

- A. Steel Shapes and Plates: ASTM A 36/A 36M.
- B. Bolts and Nuts: ASME B18.10 or ASTM A 183, steel, hex head.
- C. Washers: ASTM F 844, steel, plain, flat washers.
- D. Mechanical Fasteners: Insert-wedge-type stud with expansion plug anchor for use in hardened portland cement concrete, and tension and shear capacities appropriate for application.
 - 1. Stud: Threaded, zinc-coated carbon steel.
 - 2. Expansion Plug: Zinc-coated steel.
 - 3. Washer and Nut: Zinc-coated steel.
- E. Concrete: Portland cement mix, **3000 psi** minimum. Comply with requirements in Division 03 Section "Cast-in-Place Concrete" for formwork, reinforcement, and concrete.
- F. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink, 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 EXPANSION-JOINT INSTALLATION

- A. Install manufactured, nonmetallic expansion joints according to FSA's "Technical Handbook: Non-Metallic Expansion Joints and Flexible Pipe Connectors."
- B. Install expansion joints of sizes matching size of piping in which they are installed.
- C. Install alignment guides to allow expansion and to avoid end-loading and torsional stress.

3.2 PIPE BEND AND LOOP INSTALLATION

- A. Install pipe bends and loops cold-sprung in tension or compression as required to partly absorb tension or compression produced during anticipated change in temperature.
- B. Attach pipe bends and loops to anchors.
 - 1. Steel Anchors: Attach by welding. Comply with ASME B31.9 and ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
 - 2. Concrete Anchors: Attach by fasteners. Follow fastener manufacturer's written instructions.

3.3 SWING CONNECTIONS

- A. Connect risers and branch connections to mains with at least five pipe fittings, including tee in main.
- B. Connect risers and branch connections to terminal units with at least four pipe fittings, including tee in riser.
- C. Connect mains and branch connections to terminal units with at least four pipe fittings, including tee in main.

3.4 ALIGNMENT-GUIDE INSTALLATION

- A. Install guides on piping adjoining pipe expansion fittings and loops.
- B. Attach guides to pipe and secure to building structure.

3.5 ANCHOR INSTALLATION

- A. Install anchors at locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.
- B. Fabricate and install steel anchors by welding steel shapes, plates, and bars to piping and to structure. Comply with ASME B31.9 and AWS D1.1.
- C. Construct concrete anchors of poured-in-place concrete of dimensions indicated and include embedded fasteners.
- D. Install pipe anchors according to expansion-joint manufacturer's written instructions if expansion joints are indicated.
- E. Use grout to form flat bearing surfaces for expansion fittings, guides, and anchors installed on or in concrete.

END OF SECTION

SECTION 220517 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Sleeves.
 - 2. Sleeve-seal systems.
 - 3. Grout.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.
- C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.
- D. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.
- E. Galvanized-Steel-Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

2.2 SLEEVE-SEAL SYSTEMS

- A. Manufacturers: Subject to compliance with requirements,
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following:
 - 1. Advance Products & Systems, Inc.
 - 2. CALPICO, Inc.

3. Metraflex Company (The).
 4. Pipeline Seal and Insulator, Inc.
 5. Proco Products, Inc.
- C. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
1. Sealing Elements: **EPDM-rubber or NBR** interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 2. Pressure Plates: **Carbon steel or Stainless steel**.
 3. Connecting Bolts and Nuts: **Carbon steel, with corrosion-resistant coating, or Stainless steel** of length required to secure pressure plates to sealing elements.

2.3 GROUT

- A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: **5000-psi (34.5-MPa)**, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

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 (25-mm)**] 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. 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.
 2. Using grout, 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 (6.4-mm)** 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. Comply with requirements for sealants specified in Division 07 Section "Joint Sealants."
- E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Division 07 Section "Penetration Firestopping."

3.2 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.

3.3 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 (DN 150)]** **Cast-iron wall sleeves** or **Galvanized-steel wall sleeves**
 - b. Piping **[NPS 6 (DN 150)]** and Larger: **Cast-iron wall sleeves** or **Galvanized-steel wall sleeves**
 - 2. Exterior Concrete Walls below Grade:
 - a. Piping Smaller Than **[NPS 6 (DN 150)]** **Galvanized-steel wall sleeves with sleeve-seal system** or **Galvanized-steel-pipe sleeves with sleeve-seal system**
 - 1) Select sleeve size to allow for **1-inch (25-mm)** annular clear space between piping and sleeve for installing sleeve-seal system.
 - b. Piping **[NPS 6 (DN 150)]** and Larger: **[Galvanized-steel wall sleeves with sleeve-seal system or Galvanized-steel-pipe sleeves with sleeve-seal system]**

- 1) Select sleeve size to allow for **1-inch (25-mm)** annular clear space between piping and sleeve for installing sleeve-seal system.
3. Concrete Slabs-on-Grade:
 - a. Piping Smaller Than [**NPS 6 (DN 150)**] **Galvanized-steel wall sleeves with sleeve-seal system** or **Galvanized-steel-pipe sleeves with sleeve-seal system**
 - b. Select sleeve size to allow for **1-inch (25-mm)** annular clear space between piping and sleeve for installing sleeve-seal system.
 - a. Piping [**NPS 6 (DN 150)**] and Larger: **Galvanized-steel wall sleeves with sleeve-seal system** or **Galvanized-steel-pipe sleeves with sleeve-seal system**
 - b. Retain first subparagraph below if using sleeve-seal systems; delete if using only galvanized-steel-pipe sleeves.
 - 1) Select sleeve size to allow for **1-inch (25-mm)** annular clear space between piping and sleeve for installing sleeve-seal system.
4. Concrete Slabs above Grade:
 - a. Piping Smaller Than [**NPS 6 (DN 150)**] **Galvanized-steel-pipe sleeves or PVC-pipe sleeves**
 - b. Piping [**NPS 6 (DN 150)**] and Larger: **Galvanized-steel-pipe sleeves or PVC-pipe sleeves.**
5. Interior Partitions:
 - a. Piping Smaller Than [**NPS 6 (DN 150)**] **Galvanized-steel-pipe sleeves or PVC-pipe sleeves**
 - b. Piping [**NPS 6 (DN 150)**] and Larger: **Galvanized-steel-pipe sleeves or PVC-pipe sleeves.**

END OF SECTION 220517

SECTION 22 05 19 - METERS AND GAGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Thermometers.
 - 2. Gages.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 SOLAR DIGITAL THERMOMETER

- A. Manufacturers: Subject to compliance with requirements, provide product by one of the following: Sika, Miljoco, Weiss, Weksler
- B. Case: High impact ABS plastic.
- C. Stem: Copper-plated steel, aluminum, or brass for thermowell installation and of length to suit installation.
- D. Range: -50°F to 300 °F minimum, field switchable between Fahrenheit and Celsius.
- E. Accuracy: Greater value of 1° or 1%.
- F. Resolution: 0.1°.
- G. Recalibration: Internal potentiometer.
- H. Power: Bi-directional solar photovoltaic elements.
- I. Environmental Conditions
 - 1. Ambient Temperature: -30°F to 140 °F.
 - 2. Maximum Relative Humidity: 100%.

2.2 THERMOWELLS

- A. Manufacturers: Same as manufacturer of thermometer being used.
- B. Description: Pressure-tight, socket-type metal fitting made for insertion into piping and of type, diameter, and length required to hold thermometer.

2.3 PRESSURE GAGES

- A. Manufacturers: Subject to compliance with requirements, provide product by one of the following: AMETEK, Inc., Ernst Gage Co., Eugene Ernst Products Co., KOBOLD Instruments, Inc., Marsh Bellofram, Miljoco Corp., Noshok, Inc., Palmer - Wahl Instruments Inc., REO TEMP Instrument Corporation, Terice, H. O. Co., Weiss Instruments, Inc., Weksler Instruments Operating Unit, WIKA Instrument Corporation, Winters Instruments.
- B. Direct-Mounting, Dial-Type Pressure Gages: Indicating-dial type complying with ASME B40.100.
 - 1. Case: Liquid-filled type, drawn steel or cast aluminum, 6-inch diameter.
 - 2. Pressure-Element Assembly: Bourdon tube, unless otherwise indicated.
 - 3. Pressure Connection: Brass, NPS 1/4, bottom-outlet type unless back-outlet type is indicated.
 - 4. Movement: Mechanical, with link to pressure element and connection to pointer.
 - 5. Dial: Satin-faced, nonreflective aluminum with permanently etched scale markings.
 - 6. Pointer: Red or other dark-color metal.
 - 7. Window: Glass or plastic.
 - 8. Ring: Metal or plastic.
 - 9. Accuracy: Grade C, plus or minus 3 percent of middle half scale.
 - 10. Vacuum-Pressure Range: 30-in. Hg of vacuum to 15 psig of pressure.
 - 11. Range for Fluids under Pressure: Two times operating pressure.
- C. Pressure-Gage Fittings:
 - 1. Valves: NPS 1/4 brass or stainless-steel needle type.
 - 2. Syphons: NPS 1/4 coil of brass tubing with threaded ends.
 - 3. Snubbers: ASME B40.5, NPS 1/4 brass bushing with corrosion-resistant, porous-metal disc of material suitable for system fluid and working pressure.

PART 3 - EXECUTION

3.1 THERMOMETER APPLICATIONS

- A. Install solar powered digital thermometers in piping as shown on Drawings.
- B. Install bimetallic-actuated dial thermometers in the following locations on ductwork as shown on Drawings.

3.2 GAGE APPLICATIONS

- A. Install pressure gages as shown on Drawings.

3.3 INSTALLATIONS

- A. Install direct-mounting thermometers and adjust vertical and tilted positions.
- B. Install thermowells with socket extending to center of pipe and in vertical position in piping tees where thermometers are indicated.
- C. Install direct-mounting pressure gages in piping tees with pressure gage located on pipe at most readable position.
- D. Install needle-valve and snubber fitting in piping for each pressure gage for fluids (except steam).
- E. Install needle-valve and syphon fitting in piping for each pressure gage for steam.

3.4 CONNECTIONS

- A. Install meters and gages adjacent to machines and equipment to allow service and maintenance for meters, gages, machines, and equipment.

3.5 ADJUSTING

- A. Calibrate thermometers according to manufacturer's written instructions, after installation.
- B. Adjust faces of meters and gages to proper angle for best visibility.

END OF SECTION

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SECTION 22 05 23 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Water System Valves
 - a. Ball Valves
 - b. Butterfly Valves
 - c. Swing Check Valves
 - d. Spring Loaded Check Valves
 - e. Stop & Waste Valves
 - f. Balance Valves
 - g. Drain Valves
 - h. Buried Water Service Valves
 - i. Corporation Stop Valves
 - j. Curb Stop Valves
2. Waste System Valves
 - a. Gate Valves
 - b. Ball Valves
 - c. Swing Check Valves
 - d. Spring Loaded Check Valves
3. Natural Gas Systems
 - a. Shut-off Valves
 - b. Exterior Below Grade Shutoff Valves
 - c. Gas Pressure Regulators
4. Compressed Air Systems
 - a. Shut-off Valves
 - b. Safety Exhaust Shut-off Valves
 - c. Pressure Reducing Valves
5. Specialty Valves and Valve Accessories
 - a. Gauge Valves
 - b. Water Pressure Reducing Valves
 - c. Safety Relief Valves
 - d. Sewer Air and Vacuum Valves

B. Related Sections:

1. Division 22 plumbing piping Sections for specialty valves applicable to those Sections only.
2. Division 22 Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

1.2 SUBMITTALS

- A. Product Data: For each type of valve indicated.

1.3 QUALITY ASSURANCE

- A. ASME Compliance: ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
- B. NSF Compliance: NSF 61 for valve materials for potable-water service.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Refer to valve schedule articles for applications of valves.
- B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- C. Valve Sizes: Same as upstream piping unless otherwise indicated.
- D. Each valve type shall be of same manufacturer.
- E. Valve Actuator Types:
 - 1. Gear Actuator: For quarter-turn valves **NPS 8** and larger.
 - 2. Handwheel: For valves other than quarter-turn types.
 - 3. Handlever: For quarter-turn valves **NPS 6** and smaller[**except plug valves**].
 - 4. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator; of size and with chain for mounting height, as indicated in the "Valve Installation" Article.
- F. Valves in Insulated Piping: With **2-inch** stem extensions and the following features:
 - 1. Gate Valves: With rising stem.
 - 2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
 - 3. Butterfly Valves: With extended neck.
- G. Valve-End Connections:
 - 1. Flanged: With flanges according to ASME B16.1 for iron valves.
 - 2. Solder Joint: With sockets according to ASME B16.18.
 - 3. Threaded: With threads according to ASME B1.20.1.

2.2 WATER SYSTEM VALVES

- A. All water system valves to be rated at not less than 125 water working pressure at 240 degrees F unless noted otherwise.
- B. Ball valves:
 - 1. 3" and smaller: Two or three piece bronze body; sweat ends, chrome plated bronze ball; glass filled teflon seat; teflon packing and threaded packing nut; blowout-proof stem; 600 psig WOG. Provide valve stem extensions for valves installed in all piping with insulation. Apollo 70-200, Grinnell 3700, Hammond 8511, Milwaukee BA150, Nibco S580-70, Watts B-6001.
- C. Butterfly valves:
 - 1. 2-1/2" and larger: Cast or ductile iron body; stainless steel shaft; bronze, copper or teflon bushings; EPDM resilient seat; EPDM seals; bronze, aluminum-bronze, EPDM encapsulated ductile iron or stainless steel disc. 200 psig WOG through 12", 150 psig WOG through 24". Valve assembly to be bubble tight to 175 psig with no downstream flange/pipe attached. Use tapped lug type valves with stud bolts or cap screws, or grooved end connection valves, permitting removal of downstream piping while using the valve for system shutoff. Centerline LT series, DeZurik 632, Grinnell Series 8000, Hammond 6200 Series, Milwaukee M or C Series, Nibco LD2000/LC2860, Victaulic 300/608/700/709, Watts BF-03.
 - 2. Provide 10 position locking lever handle actuators for valves 6" and smaller. Provide worm gear operators with external position indication for valves 8" and larger.
 - 3. Provide valve stem and neck extensions for butterfly valves when used in low temperature service subject to condensation buildup where handles do not clear insulation.
- D. Swing check valves:

1. 3" and smaller: Bronze body, sweat ends, Y-pattern, regrindable bronze seat, renewable bronze disc, Class 125, suitable for installation in a horizontal or vertical line with flow upward. Crane 1342, Grinnell 3300SJ, Hammond IB941, Nibco S413B, Watts CVYS.
 2. 4" and larger: Cast iron body, flanged ends, bronze trim, bolted cap, renewable bronze seat and disc, Class 125, non-asbestos gasket, suitable for installation in a horizontal or vertical line with flow upward. Crane 373, Grinnell 6300A, Hammond IR1124, Milwaukee F2974, Nibco F918B, Watts Series 411.
- E. Spring loaded check valves:
1. 2" and smaller: Bronze body, sweat or threaded ends, bronze trim, stainless steel spring, stainless steel center guide pin, Class 125, teflon seat unless only bronze available. ConBraCo 61 series, Grinnell 3600SJ, Mueller 203BP, Nibco S480Y, Val-Matic S1400 series.
 2. 2-1/2" and larger: Cast or ductile iron body, wafer or globe type, bronze trim, bronze or EPDM seat, stainless steel spring, stainless steel stem if stem is required, Class 125. APCO 300 or 600 series, Centerline CLC with full body option, Hammond IR9354, Milwaukee 1800 series, Mueller Steam 101AP or 105AP, Nibco W910 or F910, Val-Matic 1400 or 1800 or 8000 series.
- F. STOP & WASTE VALVES:
1. 1" and smaller, Bronze body, sweat or threaded ends, 400 psi WOG, stainless steel ball and stem, full port ball valve, with threaded drain cap, Watts B-6300/6301 SS series. Apollo, Grinnell, Hammond, Milwaukee or Nibco manufacturer.
- G. Balance valves:
1. 2" and smaller: Two or three piece bronze body ball valve, sweat or threaded ends, chrome plated brass ball, glass filled teflon seat, threaded packing nut, with adjustable memory stop position indicator and extended handle stem, suitable for 400 psig water working pressure at 240 degrees F. Watts B-6000/B-6001 BS Apollo, Grinnell, Hammond, Milwaukee Or Nibco manufacturer.
- H. Drain valves:
1. 3/4 inch ball valve with integral threaded hose adapter, sweat or threaded inlet connections, with threaded cap and chain on hose threads, Watts B-6000-CC/B-6001-CC series.
- I. Buried Water Service Gate valves:
1. Cast iron body, resilient elastomer coated cast iron disc, permanently lubricated stuffing box, bronze non-rising stem and stem nut, double O-ring stem seal, Delrin thrust bearings, electroplated nuts and bolts, cast iron operating nut, AWWA C509, rated for 200 psi. Coat valve inside and out with fusion bonded epoxy, AWWA C550. Clow F-6100, Kennedy 1571, M&H 3067, Mueller A-2360, Waterous 500, Watts 406RW.
- J. UNDERGROUND WATER SERVICE BUTTERFLY VALVES:
1. Rubber-seated butterfly valve meeting the requirements of AWWA C504, for Class 150B. Body and disc shall be constructed of cast iron. Disc shall be lens shaped.
 2. Interior and exterior surfaces of valve shall be provided with epoxy coating meeting the requirements of AWWA C550. Disc shall be provided with a stainless steel disc edge.
 3. Valve stem shall be stainless steel. Packing shall be permanent duty "chevron V-type" or "O-ring" type. Bearings shall be permanent, non-metallic, and self-lubricating.
 4. Valve seat shall be a single piece of elastomeric material that is not penetrated by the valve shaft.
 5. Provide manual operator that is suitable for underground service and includes a standard 2" square operating nut.
 6. Valve shall be provided with mechanical joint connections.
 7. Mueller, Clow, Henry Pratt, or approved equal.
- K. Corporation Stop valves:
1. 2" and smaller: Bronze body ground key valve, bronze plug, AWWA taper thread inlet and copper flare outlet nut connections or compression type, AWWA C800.
- L. Curb Stop valves:
1. 2" and smaller: Bronze body plug valve, bronze plug, quarter turn check, O-ring seals, copper flare nut connections or compression type, AWWA C800.

2.3 VALVE BOXES:

A. GATE/BUTTERFLY VALVE BOXES:

1. Valve boxes shall be 5 1/4", cast iron valve boxes. Boxes shall be threaded, three-piece design with stay-put "WATER" cover. Provide appropriately sized bonnet.
2. Provide valve box extensions as necessary to accommodate depth of cover shown on plans, or 6.5' minimum.
3. Valve boxes shall be Tyler, or approved equal.

2.4 CURB STOP BOXES:

- A.** Curb stop boxes shall be 1 1/4" minimum diameter, cast iron, arch style, valve boxes. Boxes shall be telescopic, extendable to accommodate 7' bury. Lid shall be two piece threaded, with a plug having a pentagonal bolt for removal.
- B.** Ford, Mueller, or approved equal.

2.5 WASTE SYSTEM VALVES

A. Gate valves:

1. 2" and smaller: Bronze body, bronze trim, threaded ends, solid wedge, rising stem, union bonnet, malleable iron hand wheel, suitable for 300 psi WOG. Crane 431UB, Grinnell 3080, Hammond IB629, Lunkenheimer 3151, Milwaukee 1151(M), Nibco T134, Powell 2714, Stockham B120.
2. 2-1/2" and larger: Iron body, bronze trim, bolted bonnet, O.S. & Y., solid wedge, flanged, suitable for 200 psi WOG. Crane 465-1/2, Grinnell 6020A, Hammond IR1140, Lunkenheimer 1430, Milwaukee F2885, Nibco F617-O, Powell 1793, Stockham G623.

B. Ball valves:

1. 3" and smaller: Two or three piece bronze body; sweat or threaded ends, chrome plated bronze ball; glass filled teflon seat; teflon packing and threaded packing nut; blowout-proof stem; 400 psig WOG. Apollo 70-200, Grinnell 3700, Hammond 8511, Milwaukee BA150, Nibco S585-70, Watts B-6001.

C. Swing check valves:

1. 1-1/2" and smaller: Bronze body, threaded ends, Y-pattern, regrindable bronze seat, renewable bronze disc, Class 125, suitable for installation in a horizontal or vertical line with flow upward. Crane 1342, Grinnell 3300SJ, Hammond IB941, Nibco S413B, Watts CVYS.
2. 2" and larger: Cast iron body, flanged ends, bronze trim, bolted cap, renewable bronze seat and disc, Class 125, non-asbestos gasket, outside lever and weight or spring, suitable for installation in a horizontal or vertical line with flow upward. Crane 383, Grinnell 6300A, Milwaukee F2974, Nibco F918B.

D. Spring loaded check valves:

1. 2" and smaller: Bronze body, sweat or threaded ends, bronze trim, stainless steel spring, stainless steel center guide pin, Class 125, teflon seat unless only bronze available. ConBraCo 61 series, Grinnell 3600SJ, Mueller 203BP, Nibco S480Y, Val-Matic S1400 series.
2. 2-1/2" and larger: Cast or ductile iron body, wafer or globe type, bronze trim, bronze or EPDM seat, stainless steel spring, stainless steel stem if stem is required, Class 125. APCO 300 or 600 series, Centerline CLC with full body option, Hammond IR9354, Milwaukee 1800 series, Mueller Steam 101AP or 105AP, Nibco W910 or F910, Val-Matic 1400 or 1800 or 8000 series.

2.6 NATURAL GAS SYSTEMS

A. Shut-off valves:

1. 4" and smaller: Ball or eccentric plug valve, bronze or cast iron body, 2" and under threaded ends, 2-1/2" and over flanged ends, chrome plated bronze ball, bronze or nickel plated cast

- iron plug, TFE or Hycar seats and seals, lever handle, 175 psi W.O.G., U.L. listed for use as natural gas shut-off. Apollo 80-100, DeZurik 425.
2. 5" and larger: Cast iron body, flanged ends, stainless steel bearings, resilient faced plugs, totally enclosed hand wheel actuators, 175 psi W.O.G., U.L. listed for use as natural gas shut-off.

B. Exterior below grade shut-off valves:

1. Plug or ball valve, body of same polyethylene type as piping system, pipe stub ends, high strength plastic stem and operating nut, position indicator, polyethylene plug or polypropylene ball, Buna-N seats and double stem seals, rated for 96 psi natural gas service (150 psi non-lethal service).

C. Gas pressure regulators:

1. 2" and smaller: Cast iron body, aluminum spring and diaphragm, Nitrile diaphragm, threaded ends, 150 psi W.O.G., -20 degrees F to 150 degrees F.

2.7 COMPRESSED AIR SYSTEMS

A. Shut-off valves:

1. 3" and smaller: Two or three piece bronze body; threaded ends, chrome plated bronze ball; glass filled teflon seat; teflon packing and threaded packing nut; blowout-proof stem; 600 psig WOG. Apollo 70-100, Milwaukee BA100, Nibco T585-70 or T-590-Y, Watts B-6000.

B. Safety exhaust shut-off valves:

1. 3" and smaller: Two or three piece bronze body; threaded ends, chrome plated bronze ball; downstream vent port; glass filled teflon seat; teflon packing and threaded packing nut; blowout-proof stem; 175 psig WOG. Apollo 70-100-41, Watts B-6000.

C. Pressure reducing valves:

1. Bronze or aluminum body and trim, diaphragm or balanced piston, 250 psig maximum, 0-125 psig adjustable output, internal relief, 1/4" outlet gauge tapping.

2.8 SPECIALTY VALVES AND VALVE ACCESSORIES

A. Gauge valves:

1. Use 1/4" ball valves. Needle valves and gauge cocks will not be accepted.

B. Water pressure reducing valves:

1. Bronze body, diaphragm operated, with an integral thermal expansion bypass valve, inlet union, stainless steel strainer, renewable monel or stainless steel seat and adjustable reduced pressure range, 300 psig at 160 degrees F. Pre-set for the scheduled pressure. A. W. Cash, Conbraco, Watts, Wilkins.

C. Safety relief valves:

1. Bronze body, temperature and pressure actuated, stainless steel stem and spring, thermostat with non-metallic coating, test lever, suitable for 125 psig water working pressure at 240 degrees F, sized for full BTUH input and operating pressure of equipment, with valve capacity on metal label. For equipment less than or equal to 200,000 BTUH input, provide AGA, UL or ASME listed and labeled valve. Provide ASME listed and labeled valve for larger equipment. Bell & Gossett, A. W. Cash, Conbraco, Watts, Wilkins. Temperature and pressure relief valve shall be sized per AGA rating for BTUH input.

D. Sewer air and vacuum valves:

1. Combination air release/air and vacuum valve consisting of cast iron elongated body; size as shown on drawings; stainless steel valve, trim and float; Hycar or Buna-N rubber seat; inlet, backflushing and blowoff valves; 5' backflushing hose with quick disconnect fittings; 150 psig. Apco Series 440 SCAV, Crispin S20A/S20 Series, Val-Matic 800 Series.

PART 3 - EXECUTION

3.1 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 swing check valves for proper direction of flow and in horizontal position with hinge pin level.
- F. Install valve tags/identification per Division 22 Section "Identification for Plumbing Piping and Equipment" prior to installation of ceilings.

3.2 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.

END OF SECTION

SECTION 22 05 29 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Steel pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Metal framing systems.
 - 4. Thermal-hanger shield inserts.
 - 5. Fastener systems.
 - 6. Equipment supports.
- B. See Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
- C. See Division 22 Section "Expansion Fittings and Loops for Plumbing Piping" for pipe guides and anchors.
- D. See Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for vibration isolation devices.

1.2 DEFINITIONS

- A. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.3 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- C. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.4 SUBMITTALS

- A. Product Data: For the following:
 - 1. Steel pipe hangers and supports.
 - 2. Thermal-hanger shield inserts.
 - 3. Powder-actuated fastener systems.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following:
 - 1. Trapeze pipe hangers. Include Product Data for components.
 - 2. Metal framing systems. Include Product Data for components.
 - 3. Equipment supports.
- C. Welding certificates.

1.5 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 STEEL PIPE HANGERS AND SUPPORTS

- A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.
- B. Available Manufacturers:
 - 1. AAA Technology & Specialties Co., Inc.
 - 2. Bergen-Power Pipe Supports.
 - 3. B-Line Systems, Inc.; a division of Cooper Industries.
 - 4. Carpenter & Paterson, Inc.
 - 5. Empire Industries, Inc.

6. ERICO/Michigan Hanger Co.
7. Globe Pipe Hanger Products, Inc.
8. Grinnell Corp.
9. GS Metals Corp.
10. National Pipe Hanger Corporation.
11. PHD Manufacturing, Inc.
12. PHS Industries, Inc.
13. Piping Technology & Products, Inc.
14. Tolco Inc.

- C. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.
- E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.3 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.4 METAL FRAMING SYSTEMS

- A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.
- B. Available Manufacturers:
 1. B-Line Systems, Inc.; a division of Cooper Industries.
 2. ERICO/Michigan Hanger Co.; ERISTRUT Div.
 3. GS Metals Corp.
 4. Power-Strut Div.; Tyco International, Ltd.
 5. Thomas & Betts Corporation.
 6. Tolco Inc.
 7. Unistrut Corp.; Tyco International, Ltd.
- C. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.5 THERMAL-HANGER SHIELD INSERTS

- A. Description: **100-psig**- minimum, compressive-strength insulation insert encased in sheet metal shield.
- B. Available Manufacturers:
 1. Carpenter & Paterson, Inc.
 2. ERICO/Michigan Hanger Co.
 3. PHS Industries, Inc.
 4. Pipe Shields, Inc.
 5. Rilco Manufacturing Company, Inc.
 6. Value Engineered Products, Inc.
- C. Insulation-Insert Material for Cold Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass with vapor barrier.
- D. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass.
- E. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- F. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- G. Insert Length: Extend **2 inches** beyond sheet metal shield for piping operating below ambient air temperature.

2.6 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.
 1. Available Manufacturers:
 - a. Hilti, Inc.
 - b. ITW Ramset/Red Head.
 - c. Masterset Fastening Systems, Inc.
 - d. MKT Fastening, LLC.
 - e. Powers Fasteners.

- B. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
 - 1. Available Manufacturers:
 - a. B-Line Systems, Inc.; a division of Cooper Industries.
 - b. Empire Industries, Inc.
 - c. Hilti, Inc.
 - d. ITW Ramset/Red Head.
 - e. MKT Fastening, LLC.
 - f. Powers Fasteners.

2.7 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.8 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, 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 HANGER AND SUPPORT APPLICATIONS

- A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 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 padded hangers for piping that is subject to scratching.
- F. 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 **120 to 450 deg F** pipes, **NPS 4 to NPS 16**, 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 24**, requiring clamp flexibility and up to **4 inches** of insulation.
 - 4. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, **NPS 1/2 to NPS 8**.
 - 5. U-Bolts (MSS Type 24): For support of heavy pipes, **NPS 1/2 to NPS 30**.
 - 6. 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.
 - 7. Single Pipe Rolls (MSS Type 41): For suspension of pipes, **NPS 1 to NPS 30**, from 2 rods if longitudinal movement caused by expansion and contraction might occur.
 - 8. 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 not necessary.
- G. 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 20**.
 - 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, **NPS 3/4 to NPS 20**, if longer ends are required for riser clamps.
- H. 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.
 - I. 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-joint 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. 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.
 8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
 - J. 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.
 - K. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
 2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
 3. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.
 - L. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.
 - M. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.
 - N. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.
- 3.2 HANGER AND SUPPORT INSTALLATION**
- A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
 - B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. 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 above for individual pipe hangers.
 2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.
 - C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.
 - D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
 - E. Fastener System Installation:

1. Install powder-actuated fasteners 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. Install hangers and supports complete with necessary 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 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 so maximum pipe deflections allowed by ASME B31.9 (for building services piping) are not exceeded.
- M. Insulated Piping: Comply with the following:
 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 according to 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.
 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 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 inserts.
 6. Insert Material: Length at least as long as protective shield.
 7. 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 smooth bearing surface.
- 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 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 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.

3.6 PAINTING

- A. Touch Up: 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 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 A 780.

END OF SECTION

SECTION 22 05 48 - VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes performance requirements for delegated design of vibration and seismic controls.

1.2 PERFORMANCE REQUIREMENTS

- A. Seismic-Restraint Loading: Refer to Structural Drawings for Seismic Design Category, Building Use Group, and Seismic design parameters.

1.3 SUBMITTALS

- A. Product Data: For all products provided.
- B. Delegated-Design Submittal: For vibration isolation and seismic-restraint calculations and details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Welding certificates.
- D. Qualification Data: For professional engineer, NC Seal.
- E. Field quality-control test reports.

1.4 QUALITY ASSURANCE

- A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.
- B. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- C. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproved by ICC-ES, or preapproved by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

PART 2 - PRODUCTS

- A. Products shall be selected by engineer providing delegated design services.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.
- B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Delegated Design Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.
- C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.2 VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

- A. Equipment Restraints:
 - 1. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds **0.125 inches**.
 - 2. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.
- B. Piping Restraints:
 - 1. Comply with requirements in MSS SP-127.
- C. Install cables so they do not bend across edges of adjacent equipment or building structure.
- D. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.
- E. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
- F. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords or bar joists, or at concrete members.

G. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Set anchors to manufacturer's recommended torque, using a torque wrench.
5. Install zinc-coated steel anchors for interior and stainless steel anchors for exterior applications.

3.3 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

- A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Division 22 Section "Domestic Water Piping" for piping flexible connections.

3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
 2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
 3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
 4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
 5. Test to 90 percent of rated proof load of device.
 6. Measure isolator restraint clearance.
 7. Measure isolator deflection.
 8. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.
- C. Remove and replace malfunctioning units and retest as specified above.
- D. Prepare test and inspection reports, certified by Professional Engineer who provided Delegated Design.

3.5 ADJUSTING

- A. Adjust isolators after piping system is at operating weight.
- B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.
- C. Adjust active height of spring isolators.
- D. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION

SECTION 22 05 53 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Equipment labels.
 - 2. Pipe labels.
 - 3. Valve tags.
 - 4. Ceiling markers for concealed valves.

1.2 SUBMITTAL

- A. Product Data: For each type of product indicated.
- B. Color Code Schedule: Per ANSI/ASME A13.1

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. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 - 3. 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.
 - 4. Fasteners: Stainless-steel rivets or self-tapping screws.
- B. Plastic Labels for Equipment:
 - 1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
 - 2. Letter Color: White.
 - 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-fourths the size of principal lettering.
 - 7. Fasteners: Stainless-steel rivets or self-tapping screws.

- C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus 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), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 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. Stenciling is not allowed.
- C. 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: At least 1-1/2 inches high.

2.3 VALVE TAGS

- A. General Requirements for Valve Tags: 1-1/2" diameter 19 gage brass, black-filled.
- B. Lettering: 1/4" top line service abbreviation, 1/2" bottom line sequential number.
- C. Mounting: #16 brass jack chain.

2.4 CEILING MARKERS

- A. All concealed plumbing items are to be indicated on the ceiling to readily show their location. The contractor to either use color coding per the Site standard or ANSI/ASME A13.1 for color selection. Marking shall be a color dot sticker.

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 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.

- B. Locate equipment labels where accessible and visible.
- C. Install all pipe labels, equipment labels, and valve tags prior to concealing piping, equipment, or valves.

3.3 PIPE LABEL INSTALLATION

- A. Piping Color-Coding: Painting of piping is specified in Division 09 Section "Interior Painting High-Performance Coatings."
- B. 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. Pipe Label Color Schedule: Per ANSI/ASME A13.1 for the following systems:
 - 1. Domestic Cold Water Piping.
 - 2. Domestic Hot Water Piping.
 - 3. Domestic Hot Water Recirculation Piping.
 - 4. Sanitary Waste Piping
 - 5. Sanitary Vent Piping
 - 6. Rain Leader
 - 7. Emergency Overflow Leader
 - 8. Dental Air
 - 9. Compressed Air
 - 10. Dental Vacuum

3.4 VALVE TAG INSTALLATION

- A. Install valve tags on valves as follows:
 - 1. All main and branch shut-off valves.
 - 2. All water heater shut-off/isolation valves.
 - 3. All pump shut-off valves.
- B. Valve tag list:
 - 1. Mount valve tag list in main mechanical equipment room, in frame under glass.
 - 2. Provide copy of valve tag list in Operation and Maintenance Manuals.
 - 3. Indicate valve tag numbers on as-built marked prints.

END OF SECTION

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SECTION 22 07 00 - PLUMBING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

1. Section Includes insulation materials and methods for plumbing piping and equipment.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings:
 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.
 8. Detail field application for each equipment type.
- C. Field quality-control reports.

1.3 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting 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 and inspecting agency.
 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
- B. Heat Loss Characteristics: Minimum pipe insulation thickness shall comply with International Energy Code Chapter 8, based on insulation having a maximum conductivity (k) of 0.27 Btu per inch/h*ft²* °F.

1.4 DEFINITIONS

- A. Concealed: shafts, furred spaces, spaces above finished ceilings, utility tunnels, and crawl spaces. All other areas, including walk-through tunnels, shall be considered exposed.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- B. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

- C. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- D. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- E. Manufacturers: Armstrong, Certainteed Manson, Childers, Dow, Extol, Halstead, H.B. Fuller, Imcoa, Knauf, Owens-Corning, Pittsburgh Corning, Rubatex, Johns-Mansville, or approved equal.
- F. Insulating materials shall be fire retardant, moisture and mildew resistant, and vermin proof.
- G. Insulation shall be suitable to receive jackets, adhesives and coatings as indicated.

2.2 RIGID FIBERGLASS INSULATION:

- A. Minimum nominal density of 3 lbs. per cu. ft., and thermal conductivity of not more than 0.23 at 75 degrees F, minimum compressive strength of 25 PSF at 10% deformation, rated for service to 450 degrees F.
- B. White kraft reinforced foil vapor barrier all service jacket, factory applied to insulation with a self-sealing pressure sensitive adhesive lap, maximum permeance of .02 perms and minimum beach puncture resistance of 50 units.

2.3 SEMI-RIGID FIBERGLASS INSULATION:

- A. Minimum nominal density of 3 lbs. per cu. ft., thermal conductivity of not more than 0.28 at 75 degrees F, minimum compressive strength of 125 PSF at 10% deformation, rated for service to 450 degrees F. Insulation fibers perpendicular to jacket and scored for wrapping cylindrical surfaces.
- B. White kraft reinforced foil vapor barrier all service jacket, factory applied to insulation with a maximum permeance of .02 perms and minimum beach puncture resistance of 50 units.

2.4 ELASTOMERIC INSULATION:

- A. Flexible closed cell, minimum nominal density of 5.5 lbs. per cu. ft., thermal conductivity of not more than 0.27 at 75 degrees F, minimum compressive strength of 4.5 psi at 25% deformation, maximum water vapor transmission of 0.17 perm inch, maximum water absorption of 6% by weight, rated for service range of -20 degrees F to 220 degrees F on piping and 180 degrees F where adhered to equipment.

2.5 URETHANE INSULATION:

- A. Rigid closed cell polyisocyanurate, minimum nominal density of 1.8 lbs. per cu. ft., thermal conductivity of not more than 0.19 at 75 degrees F aged 180 days, minimum compressive strength of 19 psi parallel and 10 psi perpendicular, maximum water vapor transmission of 4 perm inch, maximum water absorption of .2% by volume, rated for service range of -290 degrees F to 300 degrees F.

2.6 PVC FITTING COVERS AND JACKETS:

- A. White PVC film, gloss finish one side, semi-gloss other side, FS LP-535D, Composition A, Type II, Grade GU. Ultraviolet inhibited indoor/outdoor grade to be used where exposed to high humidity, ultraviolet radiation, in kitchens or food processing areas or installed outdoors. Jacket thickness to be .02 inch (20 mil).

2.7 INSULATION INSERTS AND PIPE SHIELDS

- A. Manufacturers: B-Line, Pipe Shields, Value Engineered Products

- B. Construct inserts with calcium silicate, minimum 140 psi compressive strength. Piping 12" and larger, supplement with high density 600 psi structural calcium silicate insert. Provide galvanized steel shield. Insert and shield to be minimum 180 degree coverage on bottom of supported piping and full 360 degree coverage on clamped piping. On roller mounted piping and piping designed to slide on support, provide additional load distribution steel plate.
- C. Where contractor proposes shop/site fabricated inserts and shields, submit schedule of materials, thicknesses, gauges and lengths for each pipe size to demonstrate equivalency to pre-engineered pre-manufactured product described above. On low temperature systems, extruded polystyrene may be substituted for calcium silicate provided insert and shield length and gauge are increased to compensate for lower insulation compressive strength.
- D. Precompressed 20# density molded fiberglass blocks, Hamfab or equal, of same thickness as adjacent insulation may be substituted for calcium silicate inserts with one 1"x 6" block for piping through 2-1/2" and three 1" x 6" blocks for piping through 4". Submit shield schedule to demonstrate equivalency to pre-engineered/pre-manufactured product described above.
- E. Wood blocks will not be accepted.

2.8 ACCESSORIES

- A. All products shall be compatible with surfaces and materials on which they are applied, and be suitable for use at operating temperatures of the systems to which they are applied.
- B. Adhesives, sealants, and protective finishes shall be as recommended by insulation manufacturer for applications specified.
- C. Insulation bands to be 3/4 inch wide, constructed of aluminum or stainless steel. Minimum thickness to be .015 inch for aluminum and .010 inch for stainless steel.
- D. Tack fasteners to be stainless steel ring grooved shank tacks.
- E. Staples to be clinch style.
- F. Insulating cement to be ANSI/ASTM C195, hydraulic setting mineral wool.
- G. Finishing cement to be ASTM C449.
- H. Fibrous glass or canvas fabric reinforcing shall have a minimum untreated weight of 6 oz./sq. yd.
- I. Bedding compounds to be non-shrinking and permanently flexible.
- J. Vapor barrier coatings to be non-flammable, fire resistant, polymeric resin.
- K. Fungicidal water base coating (Foster 40-20 or equal) to be compatible with vapor barrier coating.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

- C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.2 PIPING, VALVE, AND FITTING INSULATION

- A. General:
 - 1. Install insulation with butt joints and longitudinal seams closed tightly. Provide minimum 2" lap on jacket seams and 2" tape on butt joints, firmly cemented with lap adhesive. Additionally secure with staples along seams and butt joints. Coat staples with vapor barrier mastic on systems requiring vapor barrier.
 - 2. Water supply piping insulation shall be continuous throughout the building and installed adjacent to and within building walls to a point directly behind the fixture that is being supplied.
 - 3. Install insulation continuous through pipe hangers and supports with hangers and supports on the exterior of insulation.
 - 4. Where riser clamps are required to be attached directly to piping requiring vapor barrier, extend insulation and vapor barrier jacketing/coating around riser clamp.
- B. Insulation Inserts and Pipe Shields:
 - 1. Provide insulation inserts and pipe shields at all hanger and support locations. Inserts may be omitted on 3/4" and smaller copper piping provided 12" long 22 gauge pipe shields are used.
- C. Fittings and Valves:
 - 1. Fittings, valves, unions, flanges, couplings and specialties may be insulated with factory molded or built up insulation of the same thickness as adjoining insulation.
 - 2. Cover insulation with fabric reinforcing and mastic or where temperatures do not exceed 150 degrees, PVC fitting covers.
 - 3. Secure PVC fitting covers with tack fasteners and 1-1/2" band of mastic over ends, throat, seams or penetrations.
 - 4. On systems requiring vapor barrier, use vapor barrier mastic.
- D. Elastomeric and Polyolefin:
 - 1. Where practical, slip insulation on piping during pipe installation when pipe ends are open.
 - 2. Miter cut fittings allowing sufficient length to prevent stretching.
 - 3. Completely seal seams and joints for vapor tight installation.
 - 4. For elastomeric insulation, apply full bed of adhesive to both surfaces.
 - 5. For polyolefin, seal factory preglued seams with roller and field seams and joints with full bed of hot melt polyolefin glue to both surfaces.

3.3 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.
 - 3. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 4. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
 - 5. 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.
 - 3. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

4. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least **2 inches**.
 5. 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.

3.4 EQUIPMENT, TANK, AND VESSEL INSULATION INSTALLATION

- A. Do not insulate over equipment access manholes, fittings, nameplates or ASME stamps. Bevel and seal insulation at these locations.
- B. Semi-Rigid Fiberglass:
1. Apply insulation to equipment shells using weld pins, bonding adhesive, banded and wired in place.
 2. Fill all joints, seams and depressions with insulating cement to a smooth, even surface.
 3. Cover with reinforcing fabric and 2 coats of mastic. .
 4. Use vapor barrier mastic on systems requiring a vapor barrier.
- C. Elastomeric/Polyolefin:
1. Apply full cover coat of adhesive to surface to be insulated, insulation and edge butt joints.
 2. Place insulation with edge joints firmly butted pressing to surface for full adhesion.
 3. Seal seams and joints vapor tight.

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. All hot and cold water piping shall be insulated.
- C. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
1. Install insulation over fittings, valves, strainers, flanges, 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 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 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 used for adjacent pipe. Overlap adjoining pipe insulation by not less than two 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 two 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 and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
 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.
 9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.
- D. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. 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.
- E. 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 adjoining pipe insulation.
 2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two 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 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
1. Inspect field-insulated equipment, 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 type of equipment defined in the "Equipment Insulation Schedule" Article. For large equipment, remove only a portion adequate to determine compliance.
 2. 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" Article.
- C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.7 Piping Insulation Schedule:

Service	Insulation	
	Types	Insulation Thickness
Hot Water Supply	Rigid Fiberglass	1"
Hot Water Circulating	Rigid Fiberglass	1"
Cold Water	Rigid Fiberglass	1/2"
Tempered Water	Rigid Fiberglass	1"
Non-Potable Cold Water	Rigid Fiberglass *	1/2"

Non-Potable Hot Water	Rigid Fiberglass *	1/2"
All Horizontal Storm		
Piping and 4'-0" of vertical		
Piping thereafter,		
& Roof Drain bodies	Rigid Fiberglass	1/2"

* = Elastomeric type is acceptable

- B. The following piping and fittings are not to be insulated:
1. Chrome plated exposed supplies and stops (except where specifically noted).
 2. Water hammer arrestors.
 3. Piping unions and flanges for systems not requiring a vapor barrier.

3.8 Equipment Insulation Schedule:

- A. Provide equipment insulation as follows:
1. Storage Tanks: Semi-Rigid Fiberglass, 2" thick.
 2. Backflow Preventer: Elastomeric, 1/2" thick, sheet type, pipe size type or combination of both. Fabricated for ease of removal and replacement when testing and servicing is required

END OF SECTION

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SECTION 22 11 13 - FACILITY WATER DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes water-distribution piping and related components outside the building for **water service**.
- B. Utility-furnished products include water meters that will be furnished to the site, ready for installation.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Detail precast concrete vault assemblies and indicate dimensions, method of field assembly, and components.
- C. Field quality-control test reports.
- D. Operation and maintenance data.

1.3 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.
 - 2. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.
 - 3. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.
- B. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- C. Comply with ASTM F 645 for selection, design, and installation of thermoplastic water piping.
- D. Comply with FMG's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.
- E. NSF Compliance:
 - 1. Comply with NSF 14 for plastic potable-water-service piping. **Include marking "NSF-pw" on piping.**
 - 2. Comply with NSF 61 for materials for water-service piping and specialties for domestic water.

1.4 PROJECT CONDITIONS

- A. Interruption of Existing Water-Distribution 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 water-distribution service according to requirements indicated:
 - 1. Notify **Construction Manager** no fewer than **two** days in advance of proposed interruption of service.
 - 2. Do not proceed with interruption of water-distribution service without **Construction Manager's** written permission.

1.5 COORDINATION

- A. Coordinate connection to water main with utility company.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

- A. Soft Copper Tube: **ASTM B 88, Type K**, water tube, annealed temper.
 - 1. Copper, Solder-Joint Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.
- B. Hard Copper Tube: **ASTM B 88, Type K**, water tube, drawn temper.
 - 1. Copper, Solder-Joint Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.

2.2 JOINING MATERIALS

- A. Refer to Division 22 Section "Common Work Results for Plumbing" for commonly used joining materials.
- B. Brazing Filler Metals: AWS A5.8, BCuP Series.

2.3 PIPING SPECIALTIES

- A. Transition Fittings: Manufactured fitting or coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Refer to Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

- A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications.
- B. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used, unless otherwise indicated.
- C. Do not use flanges or unions for underground piping.
- D. Flanges, unions, and special fittings may be used, instead of joints indicated, on aboveground piping and piping in vaults.
- E. Underground water-service piping **NPS 3/4 to NPS 3** shall be soft copper tube, **ASTM B 88, Type K**; wrought-copper, solder-joint fittings; and brazed joints.
- F. Underground water-service piping **NPS 4 and NPS 6** shall be **any of** the following:
 - 1. Soft copper tube, **ASTM B 88, Type K**; wrought-copper, solder-joint fittings; and brazed joints.

3.3 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. See Division 22 Section "Common Work Results for Plumbing" for piping-system common requirements.

3.4 PIPING INSTALLATION

- A. Bury piping with depth of cover over top at least **24 inches**.
- B. Extend water-service piping and connect to water-supply source and building-water-piping systems at outside face of building wall in locations and pipe sizes indicated.
 - 1. Terminate water-service piping at building wall until building-water-piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building-water-piping systems when those systems are installed.
- C. Sleeves are specified in Division 22 Section "Common Work Results for Plumbing."
- D. Mechanical sleeve seals are specified in Division 22 Section "Common Work Results for Plumbing."

3.5 CLEANING

- A. Clean and disinfect water-distribution piping as follows:
 - 1. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.
 - 2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.
 - 3. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or do as follows:
 - a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours.
 - b. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow to stand for 3 hours.
 - c. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
 - d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.
- B. Prepare reports of purging and disinfecting activities.

END OF SECTION

SECTION 22 11 16 – DOMESTIC WATER AND COMPRESSED AIR PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Under-building slab and aboveground domestic water pipes, tubes, fittings, and specialties inside the building. The compressed air piping and valves are also included as shown on the drawings.
2. Specialty valves.
3. Flexible connectors.
4. Water meters furnished by utility company for installation by Contractor.
5. Water meters.

B. Related Section:

1. Division 22 Section "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.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control reports.

1.3 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 61 for potable domestic water piping and components.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. 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.

2.2 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.
1. Cast-Copper Solder-Joint Fittings: ASME B16.18, pressure fittings.
 2. Wrought-Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
 3. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.

4. 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.
- B. Soft Copper Tube: ASTM B 88, Type K water tube, annealed temper.
 1. Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.

2.3 PIPING JOINING MATERIALS

- A. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- B. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.4 SPECIALTY VALVES

- A. Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for general-duty metal valves.
- B. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves, drain valves, backflow preventers, and vacuum breakers.

2.5 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.
- B. Dielectric Unions:
 1. Description:
 - a. Pressure Rating: 150 psig at 180 deg F
 - b. End Connections: Solder-joint copper alloy and threaded ferrous.

2.6 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.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING INSTALLATION

- 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 shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside the building at each domestic water service entrance. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages and Division 22 Section "Domestic Water Piping Specialties" for drain valves and strainers.
- D. Install shutoff valve immediately upstream of each dielectric fitting.
- E. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for pressure-reducing valves.
- F. Install domestic water piping level and plumb.
- G. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- H. 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.
- I. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- J. Install piping adjacent to equipment and specialties to allow service and maintenance.
- K. Install piping to permit valve servicing.
- L. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than system pressure rating used in applications below unless otherwise indicated.
- M. Install piping free of sags and bends.
- N. Install fittings for changes in direction and branch connections.
- O. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- P. Install pressure gages on suction and discharge piping from each plumbing pump and packaged booster pump. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages.

- Q. Install thermostats in hot-water circulation piping. Comply with requirements in Division 22 Section "Domestic Water Pumps" for thermostats.
- R. Install thermometers on outlet piping from each water heater. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers.
- S. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."
- T. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."
- U. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Section "Escutcheons for Plumbing Piping."

3.3 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: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Braze Joints" Chapter.
- E. Soldered Joints: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."
- F. 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.
- G. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.4 VALVE INSTALLATION

- A. General-Duty Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for valve installations.
- B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball or gate valves for piping NPS 2 (DN 50) and smaller. Use butterfly or gate valves for piping NPS 2-1/2 (DN 65) and larger.

- C. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping. Drain valves are specified in Division 22 Section "Domestic Water Piping Specialties."
 - 1. Hose-End Drain Valves: At low points in water mains, risers, and branches.
 - 2. Stop-and-Waste Drain Valves: Instead of hose-end drain valves where indicated.
- D. Install auto-flow valve in each hot-water circulation return branch and discharge side of each pump and circulator. Use ball valves for piping NPS 2 (DN 50) and smaller and butterfly valves for piping NPS 2-1/2 (DN 65) and larger. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves.

3.5 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

3.6 FLEXIBLE CONNECTOR INSTALLATION

- A. Install bronze-hose flexible connectors in copper domestic water tubing.

3.7 WATER METER INSTALLATION

- A. See details on drawings.

3.8 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for seismic-restraint devices.
- B. Comply with requirements in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support products and installation.
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch
- E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
 - 2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
 - 3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
 - 4. NPS 2-1/2: 108 inches with 1/2-inch rod.
 - 5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
 - 6. NPS 6: 10 feet with 5/8-inch rod.
- F. Install supports for vertical copper tubing every 10 feet.
- G. Where piping is installed in metal studs, install in punched hole and install plastic bushings to prevent contact between pipe and stud.

3.9 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment and machines to allow 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 required by plumbing code. Comply with requirements in Division 22 plumbing fixture Sections for connection sizes.
 - 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.

3.10 IDENTIFICATION

- A. Identify system components. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment" for identification materials and installation.
- B. Label pressure piping with system operating pressure.

3.11 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Piping Inspections:
 - 1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
 - 2. 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:
 - a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
 - 3. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
 - 4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- C. Piping Tests:

1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
 2. 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.
 3. 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.
 4. 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 to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
 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 for corrective action required.
- D. Domestic water piping will be considered defective if it does not pass tests and inspections.
- E. 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. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.
- B. Prepare and submit reports of purging and disinfecting activities.
- C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.
- D. Compressed air piping not to be water tested. Blow down piping and conduct air pressure test – to hold 200 psig for 30 minutes.

3.13 PIPING SCHEDULE

- 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. Under-building-slab, domestic water, NPS 3 and smaller, shall be the following:
 - 1. Soft copper tube, ASTM B 88, Type K; wrought-copper solder-joint fittings joints.
- D. Aboveground domestic water piping and compressed air piping, shall be:
 - 1. Hard copper tube, ASTM B 88, Type L; cast-wrought- copper solder-joint fittings; and soldered joints.

3.14 VALVE SCHEDULE

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 - 1. Shutoff Duty: Use ball valves for piping NPS 2 and smaller. Use butterfly, ball, or gate valves with flanged ends for piping NPS 2-1/2 and larger.
 - 2. Throttling Duty: Use globe valves for piping NPS 2 and smaller. Use butterfly valves with flanged ends for piping NPS 2-1/2 and larger.
 - 3. Hot-Water Circulation Piping, Balancing Duty: Memory-stop balancing valves.
 - 4. Drain Duty: Hose-end drain valves.
- B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

END OF SECTION

SECTION 22 11 17 - FACILITY GAS PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Pipes, tubes, and fittings.
 - 2. Piping specialties.
 - 3. Piping and tubing joining materials.
 - 4. Valves.
 - 5. Pressure regulators.

1.2 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.
- B. Gas System Pressure within Buildings: As shown on Drawings.
- C. Delegated Design: Design restraints and anchors for gas piping and equipment, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For facility 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.
- C. Delegated-Design Submittal: For gas piping and equipment 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 seismic restraints.
 - 2. Design Calculations: Calculate requirements for selecting seismic restraints.
- D. Welding certificates.
- E. Field quality-control reports.
- F. Operation and maintenance data.

1.4 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.

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, 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 A 234/A 234M 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. 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.

2.2 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. Corrugated stainless-steel tubing with polymer coating.
 4. Operating-Pressure Rating: **0.5 psig**.
 5. End Fittings: Zinc-coated steel.
 6. Threaded Ends: Comply with ASME B1.20.1.
 7. 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 A 126, Class B, cast iron with bolted cover and bottom drain connection.
 2. End Connections: Threaded ends for **NPS 2** and smaller.
 3. Strainer Screen: 60-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
 4. CWP Rating: **125 psig**.
- D. 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.

2.3 JOINING MATERIALS

- A. Joint Compound and Tape: Suitable for 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.

2.4 MANUAL GAS SHUTOFF VALVES

- A. 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.

2.5 MOTORIZED GAS VALVES

- A. Electrically Operated Valves: Comply with UL 429.
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. ASCO Power Technologies, LP; Division of Emerson.
 - b. Magnatrol Valve Corporation.
 - c. Parker Hannifin Corporation; Climate & Industrial Controls Group; Skinner Valve Div.
 - d. Watts Regulator Co.; Division of Watts Water Technologies, Inc.
 2. Pilot operated.
 3. Body: Brass or aluminum.
 4. Seats and Disc: Nitrile rubber.
 5. Springs and Valve Trim: Stainless steel.
 6. 120-V ac, 60 Hz, Class B, continuous-duty molded coil, and replaceable.
 7. NEMA ICS 6, Type 4, coil enclosure.
 8. Normally closed.
 9. Visual position indicator.

2.6 PRESSURE REGULATORS

- A. General Requirements:
1. Single stage and suitable for gas.
 2. Steel jacket and corrosion-resistant components.
 3. Elevation compensator.
 4. End Connections: Threaded for regulators **NPS 2** and smaller.
- B. Line Pressure Regulators: Comply with ANSI Z21.80.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Fisher Control Valves and Regulators; Division of Emerson Process Management.
 - b. Invensys.
 - c. Maxitrol Company.
 2. Body and Diaphragm Case: Cast iron or die-cast aluminum.
 3. Springs: Zinc-plated steel; interchangeable.
 4. Diaphragm Plate: Zinc-plated steel.
 5. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
 6. Orifice: Aluminum; interchangeable.
 7. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
 8. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
 9. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
 10. Overpressure Protection Device: Factory mounted on pressure regulator.
 11. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
 12. Maximum Inlet Pressure: See Drawings.

- C. Appliance Pressure Regulators: Comply with ANSI Z21.18.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Canadian Meter Company Inc.
 - b. Eaton Corporation; Controls Div.
 - c. Harper Wyman Co.
 - d. Maxitrol Company.
 - e. SCP, Inc.
 2. Body and Diaphragm Case: Die-cast aluminum.
 3. Springs: Zinc-plated steel; interchangeable.
 4. Diaphragm Plate: Zinc-plated steel.
 5. Seat Disc: Nitrile rubber.
 6. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
 7. Factory-Applied Finish: Minimum three-layer polyester and polyurethane paint finish.
 8. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.
 9. Maximum Inlet Pressure: See Drawings.

2.7 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 OUTDOOR PIPING INSTALLATION

- A. Comply with NFPA 54 and the International Fuel Gas Code for installation and purging of gas piping.
- B. Install underground, gas piping buried at least **36 inches** below finished grade. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.
1. If gas piping is installed less than **36 inches** below finished grade, install it in containment conduit.
- C. Install underground, PE, gas piping according to ASTM D 2774.
- 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. Exterior-Wall Pipe Penetrations: Seal penetrations using steel or cast-iron pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for **1-inch** annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- H. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

- I. Install pressure gage downstream from each service regulator. Pressure gages are specified in Division 22 Section "Meters and Gages for Plumbing Piping."

3.2 INDOOR PIPING INSTALLATION

- A. Comply with NFPA 54 and the International Fuel Gas Code for installation and purging of 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 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. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."
- L. Verify final equipment locations for roughing-in.
- M. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.
- N. 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.
- O. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.
- P. 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.
- 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.

- T. Do not use 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. Pressure gages are specified in Division 22 Section "Meters and Gages for Plumbing Piping."

3.3 VALVE INSTALLATION

- A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing 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.

3.4 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.

3.5 HANGER AND SUPPORT INSTALLATION

- A. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:
 - 1. NPS 1 and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch.
 - 2. NPS 1-1/4: Maximum span, 108 inches; minimum rod size, 3/8 inch.
 - 3. NPS 1-1/2 and NPS 2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
- B. Install hangers for horizontal, corrugated stainless-steel tubing with the following maximum spacing and minimum rod sizes:
 - 1. NPS 3/8: Maximum span, 48 inches; minimum rod size, 3/8 inch.
 - 2. NPS 1/2: Maximum span, 72 inches; minimum rod size, 3/8 inch.
 - 3. NPS 3/4 and Larger: Maximum span, 96 inches; minimum rod size, 3/8 inch.

3.6 CONNECTIONS

- A. Connect to utility's gas main according to utility's procedures and requirements.
- B. Install 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.

3.7 LABELING AND IDENTIFYING

- A. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment" for piping and valve identification. Install detectable warning tape directly above gas piping, **12 inches** below finished grade, except **6 inches** below subgrade under pavements and slabs.

3.8 FIELD QUALITY CONTROL

- A. Test, inspect, and purge gas according to NFPA 54 and the International Fuel Gas Code and authorities having jurisdiction.
- B. Gas piping will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.9 OUTDOOR PIPING SCHEDULE

- A. Underground gas piping shall be one of the following:
 - 1. PE pipe and fittings joined by heat fusion; service-line risers with tracer wire terminated in an accessible location.
 - 2. Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.
 - 3. Annealed-temper copper tube with wrought-copper fittings and brazed joints. Coat pipe and fittings with protective coating for copper tubing.
- B. Aboveground gas piping shall be one of the following:
 - 1. Steel pipe with malleable-iron fittings and threaded joints.
- C. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

3.10 INDOOR PIPING SCHEDULE

- A. Aboveground, branch piping **NPS 1** and smaller shall be one of the following:
 - 1. 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.
- C. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

- D. 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.

3.11 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: Bronze plug valves.

3.12 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. Two-piece, regular-port, bronze ball valves with bronze trim.
 - 3. Bronze plug valve.
- B. 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. Two-piece, regular-port, bronze ball valves with bronze trim.
 - 3. Bronze plug valve.
- C. Valves in branch piping for single appliance shall be one of the following:
 - 1. One-piece, bronze ball valve with bronze trim.
 - 2. Two-piece, regular-port, bronze ball valves with bronze trim.
 - 3. Bronze plug valve.

END OF SECTION

SECTION 22 11 19 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following domestic water piping specialties:
 - 1. Vacuum breakers.
 - 2. Backflow preventers.
 - 3. Water pressure-reducing valves.
 - 4. Balancing valves.
 - 5. Temperature-actuated water mixing valves.
 - 6. Strainers.
 - 7. Hose bibbs.
 - 8. Wall hydrants.
 - 9. Drain valves.
 - 10. Water hammer arresters.
 - 11. Trap-seal primer valves.
- B. See Division 22 Section "Domestic Water Piping" for water meters.
- C. See Division 22 Section "Drinking Fountains and Water Coolers" for water filters for water coolers.

1.2 PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig, unless otherwise indicated.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control test reports.
- C. Operation and maintenance data.

1.4 QUALITY ASSURANCE

- A. NSF Compliance:
 - 1. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."

PART 2 - PRODUCTS

2.1 VACUUM BREAKERS

- A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Conbraco Industries, Inc.
 - b. FEBCO; SPX Valves & Controls.
 - c. Watts Industries, Inc.; Water Products Div.
 - d. Zurn Plumbing Products Group; Wilkins Div.
 - 2. Standard: ASSE 1001.

3. Size: **NPS 1/4 to NPS 3**, as required to match connected piping.
4. Body: Bronze.
5. Inlet and Outlet Connections: Threaded.
6. Finish: Rough bronze.

B. Hose-Connection Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Conbraco Industries, Inc.
 - b. MIFAB, Inc.
 - c. Watts Industries, Inc.; Water Products Div.
 - d. Woodford Manufacturing Company.
 - e. Zurn Plumbing Products Group; Wilkins Div.
2. Standard: ASSE 1001.
3. Body: Bronze, nonremovable, with manual drain.
4. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
5. Finish: Chrome or nickel plated in interior finished areas, Rough bronze in equipment rooms and exterior.

2.2 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ames Co.
 - b. Conbraco Industries, Inc.
 - c. FEBCO; SPX Valves & Controls.
 - d. Watts Industries, Inc.; Water Products Div.
 - e. Zurn Plumbing Products Group; Wilkins Div.
2. Standard: ASSE 1013.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: **12 psig** maximum, through middle 1/3 of flow range.
5. Size: As shown on drawings.
6. Body: Bronze for **NPS 2** and smaller; steel with interior lining complying with AWWA C550 or that is FDA approved for **NPS 2-1/2** and larger.
7. End Connections: Threaded for **NPS 2** and smaller; flanged for **NPS 2-1/2** and larger.
8. Configuration: Designed for horizontal, straight through flow.
9. Accessories:
 - a. Valves: Ball type with threaded ends on inlet and outlet of **NPS 2** and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of **NPS 2-1/2** and larger.
 - b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

B. Double-Check Backflow-Prevention Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ames Co.
 - b. Conbraco Industries, Inc.
 - c. FEBCO; SPX Valves & Controls.
 - d. Watts Industries, Inc.; Water Products Div.
 - e. Zurn Plumbing Products Group; Wilkins Div.
2. Standard: ASSE 1015.
3. Operation: Continuous-pressure applications, unless otherwise indicated.
4. Pressure Loss: **5 psig** maximum, through middle 1/3 of flow range.
5. Size: As shown on Drawings.
6. Body: Bronze for **NPS 2** and smaller; steel with interior lining complying with AWWA C550 or that is FDA approved for **NPS 2-1/2** and larger.
7. End Connections: Threaded for **NPS 2** and smaller; flanged for **NPS 2-1/2** and larger.
8. Configuration: Designed for horizontal, straight through flow.
9. Accessories:
 - a. Valves: Ball type with threaded ends on inlet and outlet of **NPS 2** and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of **NPS 2-1/2** and larger.

C. Backflow-Preventer Test Kits:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Conbraco Industries, Inc.
 - b. FEBCO; SPX Valves & Controls.
 - c. Watts Industries, Inc.; Water Products Div.
 - d. Zurn Plumbing Products Group; Wilkins Div.
2. Description: Factory calibrated, with gages, fittings, hoses, and carrying case with test-procedure instructions.

2.3 WATER PRESSURE-REDUCING VALVES

- A. Water Regulators:
1. Basis of Design Product: as shown on drawings. Comparable products by:
 - a. Conbraco Industries, Inc.
 - b. Watts Industries, Inc.; Water Products Div.
 - c. Zurn Plumbing Products Group; Wilkins Div.
 2. Standard: ASSE 1003.
 3. Pressure Rating: Initial working pressure of **200 psig**.
 4. Size: As shown on Drawings.
 5. Body: Bronze for **NPS 2** and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for **NPS 2-1/2 and NPS 3**.
 6. Valves for Booster Heater Water Supply: Include integral bypass.
 7. End Connections: Threaded for **NPS 2** and smaller; flanged for **NPS 2-1/2 and NPS 3**.

2.4 BALANCING VALVES

- A. Auto flow control valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. FDI.
 - b. Griswold.
 - c. Hays.
 2. Pressure Rating: **400-psig** minimum CWP.
 3. Size: **NPS 2** or smaller.
 4. Body: Copper alloy.
 5. Seats and Seals: Replaceable.
 6. End Connections: Solder joint or threaded.

2.5 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. Armstrong International, Inc.
 - b. Conbraco Industries, Inc.
 - c. Leonard Valve Company.
 - d. Symmons Industries, Inc.
 - e. Zurn Plumbing Products Group; Wilkins Div.
 2. Standard: ASSE 1017.
 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: As shown on Drawings.
 9. Tempered-Water Design Flow Rate: As shown on Drawings.
 10. Valve Finish: Chrome plated or Rough bronze.
- B. Primary, Thermostatic, Water Mixing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Armstrong International, Inc.
 - b. Lawler Manufacturing Company, Inc.
 - c. Leonard Valve Company.
 - d. Symmons Industries, Inc.
2. Standard: ASSE 1017.
3. Pressure Rating: 125 psig.
4. Type: Exposed-mounting or Cabinet-type, thermostatically controlled water mixing valve.
5. Material: Bronze body with corrosion-resistant interior components.
6. Connections: Threaded union inlets and outlet.
7. Accessories: Manual temperature control, check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
8. Valve Pressure Rating: 125 psig minimum, unless otherwise indicated.
9. Tempered-Water Setting: As shown on Drawings.
10. Tempered-Water Design Flow Rate: As shown on Drawings.
11. Selected Valve Flow Rate at 45-psig Pressure Drop: As shown on Drawings.
12. Pressure Drop at Design Flow Rate: As shown on Drawings.

2.6 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 with interior lining complying with AWWA C550 or FDA-approved, epoxy coating and 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. Perforation Size:
 - a. Strainers NPS 2 and Smaller: 0.020 inch.
 - b. Strainers NPS 2-1/2 to NPS 4: 0.045 inch.
 - c. Strainers NPS 5 and Larger: 0.10 inch.
 6. Drain: Pipe plug.

2.7 HOSE BIBBS

- A. Hose Bibbs:
1. Standard: ASME A112.18.1 for sediment faucets.
 2. Body Material: Bronze.
 3. Seat: Bronze, replaceable.
 4. Supply Connections: NPS 1/2 or NPS 3/4 threaded or solder-joint inlet.
 5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
 6. Pressure Rating: 125 psig.
 7. Vacuum Breaker: Integral nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
 8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
 9. Finish for Service Areas: Rough bronze.
 10. Finish for Finished Rooms: Chrome or nickel plated.
 11. Operation for Equipment Rooms: Wheel handle or operating key.
 12. Operation for Service Areas: Wheel handle.
 13. Operation for Finished Rooms: Operating key.
 14. Include operating key with each operating-key hose bibb.
 15. Include integral wall flange with each chrome- or nickel-plated hose bibb.

2.8 WALL HYDRANTS

- A. Nonfreeze Wall Hydrants:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company.
 - b. MIFAB, Inc.

- c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
- d. Watts Drainage Products Inc.
- e. Woodford Manufacturing Company.
- f. Zurn Plumbing Products Group; Light Commercial Operation.
2. Standard: ASME A112.21.3M for exposed-outlet, self-draining wall hydrants.
3. Pressure Rating: **125 psig.**
4. Operation: Loose key.
5. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
6. Inlet: **NPS 3/4 or NPS 1.**
7. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
8. Box: Deep, flush mounting with cover.
9. Box and Cover Finish: Polished nickel bronze.
10. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
11. Nozzle and Wall-Plate Finish: Polished nickel bronze.
12. Operating Keys(s): Two with each wall hydrant.

B. Vacuum Breaker Wall Hydrants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Smith, Jay. R. Mfg. Co.; Division of Smith Industries, Inc.
 - b. Watts Industries, Inc.; Water Products Div.
 - c. Woodford Manufacturing Company.
 - d. Zurn Plumbing Products Group; Light Commercial Operation.
2. Standard: ASSE 1019, Type A or Type B.
3. Type: Freeze-resistant, automatic draining with integral air-inlet valve.
4. Classification: Type B, for automatic draining with hose removed or with hose attached and nozzle closed.
5. Pressure Rating: **125 psig.**
6. Operation: Loose key.
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.

2.9 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: **400-psig** minimum CWP.
3. Size: **NPS 3/4.**
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.10 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. Josam Company.
 - c. MIFAB, Inc.
 - d. PPP Inc.
 - e. Sioux Chief Manufacturing Company, Inc.
 - f. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - g. Tyler Pipe; Wade Div.

- h. Watts Drainage Products Inc.
- i. Zurn Plumbing Products Group; Specification Drainage Operation.
- 2. Standard: ASSE 1010 or PDI-WH 201.
- 3. Type: Copper tube with piston.
- 4. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

2.11 TRAP-SEAL PRIMER VALVES

- A. Supply-Type, Trap-Seal Primer Valves:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. MIFAB, Inc.
 - b. PPP Inc.
 - c. Sioux Chief Manufacturing Company, Inc.
 - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - e. Watts Industries, Inc.; Water Products Div.
 - 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.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.
- B. Install backflow preventers 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 not acceptable for this application.
 - 3. Do not install bypass piping around backflow preventers.
- C. Install water regulators with inlet and outlet shutoff valves and bypass with memory-stop balancing valve. Install pressure gages on inlet and outlet.
- D. Install balancing valves in locations where they can easily be adjusted.
- E. Install temperature-actuated water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.
 - 1. Install thermometers and water regulators if specified.
 - 2. Install cabinet-type units recessed in or surface mounted on wall as specified.
- F. Install Y-pattern strainers for water on supply side of each control valve, water pressure-reducing valve, solenoid valve, and pump.
- G. Install water hammer arresters in water piping according to PDI-WH 201.
- H. Install supply-type, trap-seal primer valves 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.

- I. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.
- J. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
 - 1. Intermediate atmospheric-vent backflow preventers.
 - 2. Reduced-pressure-principle backflow preventers.
 - 3. Double-check backflow-prevention assemblies.
 - 4. Water pressure-reducing valves.
 - 5. Primary, thermostatic, water mixing valves.
 - 6. Supply-type, trap-seal primer valves.
- K. 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 Division 22 Section "Identification for Plumbing Piping and Equipment."

3.2 FIELD QUALITY CONTROL

- A. Perform the following tests and prepare test reports:
 - 1. Test each backflow preventer according to authorities having jurisdiction and the device's reference standard.
- B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

3.3 ADJUSTING

- A. Set field-adjustable pressure set points of water pressure-reducing valves.
- B. Set field-adjustable flow of balancing valves.
- C. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

END OF SECTION

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SECTION 22 11 23 - DOMESTIC WATER PUMPS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following all-bronze and bronze-fitted centrifugal pumps for domestic cold- and hot-water circulation:
 - 1. Close-coupled, in-line, sealless centrifugal pumps.
- B. See Division 22 Section "Domestic-Water Packaged Booster Pumps" for booster systems.
- C. See Division 33 Section "Water Supply Wells" for well pumps.

1.2 SUBMITTALS

- A. Product Data: For each type and size of domestic water pump specified. Include certified performance curves with operating points plotted on curves; and rated capacities of selected models, furnished specialties, and accessories.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Operation and maintenance data.

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. UL Compliance: Comply with UL 778 for motor-operated water pumps.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 CLOSE-COUPLED, IN-LINE, SEALLESS CENTRIFUGAL PUMPS

- A. Manufacturers:
 - 1. Armstrong Pumps Inc.
 - 2. Bell & Gossett Domestic Pump; ITT Industries.
 - 3. Grundfos Pumps Corp.
 - 4. Taco, Inc.
- B. Description: Factory-assembled and -tested, single-stage, close-coupled, in-line, sealless centrifugal pumps as defined in HI 5.1-5.6.

1. Pump and Motor Assembly: Hermetically sealed, replaceable-cartridge-type unit with motor and impeller on common shaft and designed for installation with pump and motor shaft mounted horizontally.
2. Casing: Bronze, with threaded companion-flange connections.
3. Impeller: Corrosion-resistant material.
4. Motor: Single speed, unless otherwise indicated. Comply with requirements in Division 22 Section "Common Motor Requirements for Plumbing Equipment."

C. Capacities and Characteristics: As shown on drawings.

2.3 CONTROLS

A. Thermostats: Electric; adjustable for control of hot-water circulation pump.

1. Manufacturers:
 - a. Honeywell International, Inc.
 - b. Square D.
 - c. White-Rodgers Div.; Emerson Electric Co.
2. Type: Water-immersion sensor, for installation in hot-water circulation piping.
3. Range: **50 to 125 deg F**.
4. Operation of Pump: On or off.
5. Transformer: Provide if required.
6. Power Requirement: **120 V, ac**.
7. Settings: Start pump at **110 deg F** and stop pump at **120 deg F**.

B. Timers: Electric time clock for control of hot-water circulation pump.

1. Manufacturers:
 - a. Honeywell International, Inc.
 - b. Intermatic, Inc.
 - c. Johnson Controls, Inc.
 - d. Maple Chase Company.
 - e. TORK.
2. Type: Programmable, seven-day clock with manual override on-off switch.
3. Enclosure: Suitable for wall mounting.
4. Operation of Pump: On or off.
5. Transformer: Provide if required.
6. Power Requirement: **120 V, ac**.
7. Programmable Sequence of Operation: Up to two on-off cycles each day for seven days.

C. Time Delay Relay: Control for hot-water storage tank circulation pump.

1. Manufacturers:
 - a. Honeywell International, Inc.
 - b. Intermatic, Inc.
 - c. Johnson Controls, Inc.
 - d. Square D.
 - e. White-Rodgers Div.; Emerson Electric Co.
2. Type: Adjustable time delay relay.
3. Range: Up to five minutes.
4. Setting: Five minutes.
5. Operation of Pump: On or off.
6. Transformer: Provide if required.
7. Power Requirement: **120 V, ac**.
8. Programmable Sequence of Operation: Limit pump operation to periods of burner operation plus maximum five minutes after the burner stops.

2.4 FLEXIBLE CONNECTORS

A. Manufacturers:

1. Anamet, Inc.
2. Flex-Hose Co., Inc.

3. Flexicraft Industries.
4. Metraflex, Inc.

- B. Description: Corrugated, bronze inner tubing covered with bronze wire braid. Include copper-tube ends or bronze flanged ends, braze-welded to tubing. Include **125-psig** minimum working-pressure rating and ends matching pump connections.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with HI 1.4.
- B. Install pumps with access for periodic maintenance including removal of motors, impellers, couplings, and accessories.
- C. Independently support pumps and piping so weight of piping is not supported by pumps and weight of pumps is not supported by piping.
- D. Install **in-line, sealless** centrifugal pumps with motor and pump shafts horizontal.
- E. Install continuous-thread hanger rods and **spring hangers** of sufficient size Mechanical Vibration to support pump weight. Vibration isolation devices are specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment." Fabricate brackets or supports as required. Hanger and support materials are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
- F. Install immersion-type thermostats in hot-water return piping.
- G. Install timers [on wall in engineer's office] <Insert other>.
- H. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- I. Install piping adjacent to pumps to allow service and maintenance.
- J. Connect domestic water piping to pumps. Install suction and discharge piping equal to or greater than size of pump nozzles. Refer to Division 22 Section "Domestic Water Piping."
 1. Install flexible connectors adjacent to pumps in suction and discharge piping of close-coupled, horizontally mounted, in-line centrifugal pumps.
 2. Install shutoff valve and strainer on suction side of pumps, and check valve and throttling valve on discharge side of pumps. Install valves same size as connected piping. Refer to Division 22 Section "General-Duty Valves for Plumbing Piping" for general-duty valves for domestic water piping and Division 22 Section "Domestic Water Piping Specialties" for strainers.
 3. Install pressure gages at suction and discharge of pumps. Install at integral pressure-gage tapings where provided or install pressure-gage connectors in suction and discharge piping around pumps. Refer to Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages and gage connectors.
- K. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- L. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- M. Connect **thermostats and timers** to pumps that they control.

END OF SECTION

SECTION 22 13 16 – DRAIN, WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SUMMARY

1. This Section includes drain, waste, and vent piping, including rain water leaders and acid waste piping.

1.2 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.**

1.3 SUBMITTALS

- A. Field quality-control inspection and test reports.

1.4 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Hub-and-Spigot, Cast-Iron Pipe and Fittings: ASTM A 74, Service class, CISPI approved, domestic manufactured.
 1. Gaskets: ASTM C 564, rubber.
- B. Hubless Cast-Iron Pipe and Fittings: ASTM A 888 or CISPI 301, CISPI approved, domestic manufactured.
 1. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.
 - a. Heavy-Duty, Shielded, Stainless-Steel Couplings: With stainless-steel shield, stainless-steel bands and tightening devices, and ASTM C 564, rubber sleeve, such as Clamp All couplings rated at 15 psi with FM label.
- C. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.
 1. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought-copper, solder-joint fittings.
- D. Acid Drain: CPVC Type IV, Grade I, ASTM Cell Class 23447.
 1. All system components shall be certified by NSF International for use in chemical waste drain systems and bear the mark NSF-cw. All system piping shall be Schedule 40 CPVC produced to the dimensional requirements of ASTM F 2618 and the manufacturer's specifications. All pipe fittings shall be CPVC drainage patterns meeting the requirements of ASTM F 2618 and the manufacturer's specifications, as applicable.
 2. Solvent welded joints shall be made with ChemDrain One-Step solvent cement conforming to ASTM F 493. The system shall be protected from items that are not compatible with CPVC compounds; materials like thread sealants, plasticized vinyl products, fire stopping devices or other aggressive chemical agents.

2.2 CAST IRON ALTERNATE MATERIAL

- A. At the contractor's option, SCH 40 PVC pipe and fittings may be substituted for the cast iron system above and below the slab. PVC piping to be installed per manufacturer's instructions and the NCPC. **However, PVC will not be acceptable in any above ceiling return air plenums (coordinate with mechanical drawings for locations of return air plenums).**

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

- A. Special pipe fittings with pressure ratings at least equal to piping pressure ratings may be used in applications below, unless otherwise indicated.
- B. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.

3.2 SANITARY WASTE AND VENT

- A. Interior Above Ground may be one of the following:

1. Hubless cast iron soil pipe and fittings, ASTM A888; with no-hub couplings, CISPI 310.
 2. Type M copper water tube, H (drawn) temper, ASTM B88; with cast copper drainage fittings (DWV), ANSI B16.23; wrought copper drainage fittings (DWV), ANSI B16.29; lead free (<.2%) solder, ASTM B32; flux, ASTM B813; copper phosphorous brazing alloy, AWS A5.8 BCuP. Mechanically formed brazed tee connections may be used in lieu of specified tee fittings for vent branch takeoffs up to one-half (1/2) the diameter of the main.
 3. Galvanized steel pipe, Schedule 40, Type F, Grade A, ASTM A53; with cast iron threaded drainage fittings, ASTM B16.12.
- B. Interior Below Ground may be one of the following:
1. Cast iron soil pipe and fittings, hub and spigot, service weight, ASTM A74; with neoprene rubber compression gaskets, ASTM C564 and CISPI HSN 85.

3.3 RAIN WATER LEADERS

- A. Same as Sanitary Waste and Vent piping above. **However, PVC will not be acceptable in any above ceiling return air plenums (coordinate with mechanical drawings for locations of return air plenums).**

3.4 PIPING INSTALLATION

- A. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for Plumbing."
- B. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.
- C. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section "Common Work Results for Plumbing."
- D. Install wall penetration system at each service pipe penetration through foundation wall. Make installation watertight. Wall penetration systems are specified in Division 22 Section "Common Work Results for Plumbing."
- E. 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."
- F. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- G. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- H. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:
1. Building Sanitary Drain: 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 Drainage Piping: 2 percent downward in direction of flow.
 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- I. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.
- J. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.5 JOINT CONSTRUCTION

- A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."

- B. Cast-Iron, Soil-Piping Joints: Make joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
 - 1. Gasketed Joints: Make with rubber gasket matching class of pipe and fittings.
 - 2. Hubless Joints: Make with rubber gasket and sleeve or clamp.
- C. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

3.6 HANGER AND SUPPORT INSTALLATION

- A. Seismic-restraint devices are specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Pipe hangers and supports are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment." Install the following:
 - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs: According to the following:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet, if Indicated: MSS Type 49, spring cushion rolls.
 - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
- D. Support vertical piping and tubing at base and at each floor.
- E. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.
- F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
 - 2. NPS 3: 60 inches with 1/2-inch rod.
 - 3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
 - 4. NPS 6: 60 inches with 3/4-inch rod.
 - 5. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.
- G. Install supports for vertical cast-iron soil piping every 15 feet.
- H. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/4: 84 inches with 3/8-inch rod.
 - 2. NPS 1-1/2: 108 inches with 3/8-inch rod.
 - 3. NPS 2: 10 feet with 3/8-inch rod.
 - 4. NPS 2-1/2: 11 feet with 1/2-inch rod.
 - 5. NPS 3: 12 feet with 1/2-inch rod.
 - 6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
 - 7. NPS 6: 12 feet with 3/4-inch rod.
- I. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/4: 72 inches with 3/8-inch rod.
 - 2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
 - 3. NPS 2-1/2: 108 inches with 1/2-inch rod.
 - 4. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
 - 5. NPS 6: 10 feet with 5/8-inch rod.
- J. Install supports for vertical copper tubing every 10 feet.
- K. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.
- L. Install hangers for CPVC piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.

2. **NPS 3: 48 inches** with **1/2-inch** rod.

- M. Install supports for vertical CPVC piping every **48 inches**.

3.7 CONNECTIONS

- A. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- B. Connect drainage and vent piping to the following:
 1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 22 Section "Sanitary Waste Piping Specialties."
 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 drainage and vent piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 22 Section "Sanitary Waste Piping Specialties."
 4. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections **NPS 2-1/2** and larger.

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 drainage and vent piping according to procedures of authorities having jurisdiction.
 1. Piping shall be tested to 10' of static head, prior to backfill.
 2. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
 3. Prepare reports for tests and required corrective action.

3.9 CLEANING

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains 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.

END OF SECTION

SECTION 22 13 19 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following sanitary drainage piping specialties:
 - 1. Cleanouts.
 - 2. Floor drains.
 - 3. Miscellaneous sanitary drainage piping specialties.
 - 4. Flashing materials.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for grease interceptors.

1.3 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 CLEANOUTS

- A. Exposed Cast-Iron Cleanouts:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - c. Watts Drainage Products Inc.
 - d. Zurn Plumbing Products Group.
 - 2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
 - 3. Size: Same as connected drainage piping
 - 4. Body Material: Hub-and-spigot, cast-iron soil pipe T-branch or Hubless, cast-iron soil pipe test tee as required to match connected piping.
 - 5. Closure: Countersunk or raised-head, brass plug.
 - 6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
- B. Cast-Iron Floor Cleanouts:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - c. Watts Drainage Products Inc.
 - d. Zurn Plumbing Products Group.
 - 2. Standard: ASME A112.36.2M for adjustable housing cleanout.
 - 3. Size: Same as connected branch.
 - 4. Type: Adjustable housing.
 - 5. Body or Ferrule: Cast iron.
 - 6. Clamping Device: Not required.
 - 7. Outlet Connection: Inside calk.
 - 8. Closure: Brass plug with straight threads and gasket.
 - 9. Adjustable Housing Material: Cast iron with threads.
 - 10. Frame and Cover Material and Finish: Nickel-bronze, copper alloy in finished areas; rough bronze in service areas, equipment rooms, etc..
 - 11. Frame and Cover Shape: Round.
 - 12. Top Loading Classification: Medium Duty.
 - 13. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.
- C. Cast-Iron Wall Cleanouts:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - c. Watts Drainage Products Inc.
 - d. Zurn Plumbing Products Group.
 - 2. Standard: ASME A112.36.2M. Include wall access.

3. Size: Same as connected drainage piping.
4. Body: Hub-and-spigot, cast-iron soil pipe T-branch or Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk or raised-head, drilled-and-threaded brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.

2.2 FLOOR DRAINS

A. Cast-Iron Floor Drains:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - c. Watts Drainage Products Inc.
 - d. Zurn Plumbing Products Group.
2. Standard: ASME A112.6.3 without backwater valve.
3. Pattern: Area drain.
4. Body Material: Gray iron.
5. Seepage Flange: Required.
6. Anchor Flange: Required.
7. Clamping Device: Required.
8. Outlet: Bottom.
9. Sediment Bucket: As scheduled.
10. Top or Strainer Material: Nickel bronze.
11. Top of Body and Strainer Finish: Chrome plated Nickel bronze, except in equipment rooms.
12. Top Shape: Round, except Square in areas with hard tile floor finishes.
13. Dimensions of Top or Strainer: 5" diameter unless otherwise noted.
14. Top Loading Classification: Light Duty.
15. Funnel: Not required.
16. Trap Material: Cast iron.
17. Trap Pattern: Deep-seal P-trap.
18. Trap Features: Trap-seal primer valve drain connection.
19. Additional Requirements: See drawings for additional floor drain requirements.

2.3 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. 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.

B. 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.

C. 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.

D. 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.
- E. 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.

2.4 FLASHING MATERIALS

- A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:
 1. General Use: 4.0-lb/sq. ft., 0.0625-inch thickness.
 2. Vent Pipe Flashing: 3.0-lb/sq. ft., 0.0469-inch thickness.
 3. Burning: 6-lb/sq. ft., 0.0938-inch thickness.
- B. Fasteners: Metal compatible with material and substrate being fastened.
- C. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.
- D. Solder: ASTM B 32, lead-free alloy.
- E. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.
- 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 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. 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.
 3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
 4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
- F. Install deep-seal traps on floor drains and other waste outlets, if indicated.
- G. 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.
- H. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.
- I. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

- J. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.
- K. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.

3.3 FLASHING INSTALLATION

- A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
 - 1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft., 0.0938-inch thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft., 0.0625-inch thickness or thinner.
- B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
 - 1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
 - 2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
 - 3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.
- C. Set flashing on floors and roofs in solid coating of bituminous cement.
- D. Secure flashing into sleeve and specialty clamping ring or device.
- E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Division 07 Section "Sheet Metal Flashing and Trim."
- F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

3.4 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 Division 22 Section "Identification for Plumbing Piping and Equipment."

3.5 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 221429 - SUMP PUMPS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes submersible sump pumps and accessories, inside the building, for building storm drainage systems and elevator sump pump.
- B. See Division 22 Section "Sanitary Sewerage Pumps" for application in sanitary drainage systems.

1.2 SUBMITTALS

- A. Product Data: For each type and size of sump pump specified. Include certified performance curves with operating points plotted on curves, and rated capacities of selected models, furnished specialties, and accessories.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Operation and maintenance data.

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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Basis-of-Design Product: As shown on Drawings.
 - 2. Comparable products: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 SUBMERSIBLE SUMP PUMPS

- A. Basis of Design Product: As shown on Drawings.
- B. Comparable products by:
 - 1. Bell & Gossett Domestic Pump; ITT Industries.
 - 2. Liberty Pumps.
 - 3. Little Giant Pump Co.
 - 4. Myers, F. E.; Pentair Pump Group (The).
 - 5. Zoeller Company.
- C. Description: Factory-assembled and -tested, simplex, single-stage, centrifugal, end-suction, submersible, direct-connected sump pumps complying with UL 778 and HI 1.1-1.2 and HI 1.3 for submersible sump pumps.
- D. Casing and Impeller: Cast iron casing with metal inlet strainer and brass, bronze, or cast-iron impeller.

- E. Pump and Motor Shaft: Steel, with factory-sealed, grease-lubricated ball bearings and double-mechanical seals.
- F. Motor: Hermetically sealed, capacitor-start type, with built-in overload protection; three-conductor waterproof power cable of length required, and with grounding plug and cable-sealing assembly for connection at pump. Comply with requirements in Division 22 Section "Common Motor Requirements for Plumbing Equipment"
- G. Pump Discharge Piping: Factory or field fabricated, ASTM A 53/A 53M, Schedule 40, galvanized-steel pipe.
- H. Controls: NEMA 250, Type 6, 120-V ac, float switch, mounted on discharge piping.

PART 3 - EXECUTION

3.1 CONCRETE

- A. Install concrete bases of dimensions indicated for pumps and controllers. Refer to Division 22 Section "Common Work Results for Plumbing."
 - 1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on **18-inch** centers around full perimeter of base.
 - 2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - 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.
- B. Cast-in-place concrete materials and placement requirements are specified in Division 03.

3.2 SUMP PUMP INSTALLATION

- A. Excavating, trenching, and backfilling are specified in Division 31 Section "Earth Moving."
- B. Install sump pumps according to applicable requirements in HI 1.4.
- C. Install pumps and arrange to provide access for maintenance including removal of motors, impellers, couplings, and accessories.
- D. Set submersible sump pumps on basin or pit floor. Make direct connections to storm drainage piping.
- E. Install sump pump basins and connect to drainage piping. Brace interior of basins according to manufacturer's written instructions to prevent distortion or collapse during concrete placement. Set basin cover and fasten to basin top flange. Install cover so top surface is flush with finished floor.
- F. Construct sump pump pits and connect to drainage piping. Set pit curb frame recessed in and anchored to concrete. Fasten pit cover to pit curb flange. Install cover so top surface is flush with finished floor.
- G. Support piping so weight of piping is not supported by pumps.
- H. Install piping adjacent to sump pumps to allow service and maintenance.
- I. Connect drainage piping to pumps. Install discharge piping equal to or greater than size of pump discharge piping.
- J. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- K. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

END OF SECTION 221429

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SECTION 223300 - ELECTRIC DOMESTIC WATER HEATERS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Light-commercial electric water heaters.
 - 2. Commercial electric booster heaters.
 - 3. Water heater accessories.

1.2 SUBMITTALS

- A. Product Data: For each type and size of water heater indicated. Include rated capacities, operating characteristics, furnished specialties, and accessories.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Operation and maintenance data.
- D. Warranty.

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. ASME Compliance: Where ASME-code construction is indicated, fabricate and label commercial water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
- C. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9" for all components that will be in contact with potable water.

1.4 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of electric 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 Period(s): From date of Substantial Completion:
 - a. Commercial Electric Water Heaters: Five years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Basis of Design Product: As shown on Drawings.
 - 2. Comparable Products: As listed.

2.2 COMMERCIAL ELECTRIC WATER HEATERS

- A. Commercial, Storage Electric Water Heaters: Comply with UL 1453 requirements for storage-tank-type water heaters.
1. Basis of Design Product: As shown on Drawings.
 2. Comparable Products by one of the following:
 - a. Bock Water Heaters, Inc.
 - b. Bradford White Corporation.
 - c. Lochinvar Corporation.
 - d. State Industries, Inc.
 3. Storage-Tank Construction: Non-ASME-code, non-metallic composite material.
 - a. Tappings: Factory fabricated of materials compatible with tank and piping connections. Attach tappings to tank before testing.
 - 1) **NPS 2** and Smaller: Threaded ends according to ASME B1.20.1.
 - 2) **NPS 2-1/2** and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.
 - 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.
 4. Factory-Installed Storage-Tank Appurtenances:
 - a. Anode Rod: None required.
 - b. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
 - c. Insulation: Comply with ASHRAE/IESNA 90.1.
 - d. Jacket: High density polyethylene dent and scratch resistant.
 - e. Heating Elements: Electric, screw-in or bolt-on immersion type arranged in multiples of three.
 - 1) Staging: Input not exceeding 18 kW per step.
 - f. Temperature Control: Adjustable thermostat.
 - g. Safety Controls: High-temperature-limit and low-water cutoff devices or systems.
 - h. Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3, 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 water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.
 5. Special Requirements:
 - a. NSF 5 construction.
 - b. Compliance with North Carolina Building Code.
 6. Energy Management System Interface: Normally closed dry contacts for enabling and disabling water heater.
 7. Capacity and Characteristics: Refer to Drawings.

2.3 WATER HEATER ACCESSORIES

- A. Water Heater Stands: Water heater manufacturer's factory-fabricated steel stand for floor mounting and capable of supporting water heater and water. Include dimension that will support bottom of water heater a minimum of **18 inches** above the floor.
- B. Water Heater Mounting Brackets: Water heater manufacturer's factory-fabricated steel bracket for wall mounting and capable of supporting water heater and water.
- C. Drain Pans: Corrosion-resistant metal with raised edge. Include dimensions not less than base of water heater and include drain outlet not less than **NPS 3/4**.
- D. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1 or ASHRAE 90.2.
- E. Shock Absorbers: ASSE 1010 or PDI WH 201, Size A water hammer arrester.

PART 3 - EXECUTION

3.1 WATER HEATER INSTALLATION

- A. Install commercial water heaters on concrete bases.
 - 1. Exception: Omit concrete bases for commercial water heaters if installation on stand, bracket, suspended platform, or direct on floor is indicated.
 - 2. Concrete base construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."
- B. Install water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
- C. Install combination temperature and pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial, 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.
- D. 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 water heaters that do not have tank drains. Refer to Division 22 Section "Domestic Water Piping Specialties" for hose-end drain valves.
- E. Install thermometer on outlet piping of water heaters. Refer to Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers.
- F. Install water regulator, with integral bypass relief valve, in booster-heater inlet piping and water hammer arrester in booster-heater outlet piping.
- G. Install piping-type heat traps on inlet and outlet piping of water heater storage tanks without integral or fitting-type heat traps.
- H. Fill water heaters with water.

3.2 CONNECTIONS

- A. Install piping adjacent to water heaters to allow service and maintenance. Arrange piping for easy removal of water heaters.
- B. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- C. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

- A. Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including connections.
- B. Perform the following field tests and inspections:
 - 1. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Operational Test: After electrical circuitry has been energized, confirm proper operation.
 - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Remove and replace water heaters that do not pass tests and inspections and retest as specified above.

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain commercial electric water heaters. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 223300

SECTION 22 40 00 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Faucets for lavatories, sinks, and other fixtures.
 - 2. Flushometers.
 - 3. Toilet seats.
 - 4. Protective shielding guards.
 - 5. Fixture supports.
 - 6. Water closets.
 - 7. Urinals.
 - 8. Lavatories.
 - 9. Sinks.
 - 10. Service sinks.
 - 11. Mop sinks.
- B. Related Sections include the following:
 - 1. Division 22 Section "Drinking Fountains and Water Coolers."

1.2 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities, conforming to the requirements of the International Building Code.
- C. FRP: Fiberglass-reinforced plastic.
- D. PMMA: Polymethyl methacrylate (acrylic) plastic.
- E. PVC: Polyvinyl chloride plastic.
- F. Solid Surface: Nonporous, homogeneous, cast-polymer-plastic material with heat-, impact-, scratch-, and stain-resistance qualities.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Diagram power, signal, and control wiring, rough-in dimension drawings.
- C. Operation and maintenance data.

1.4 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. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; Public Law 101-336, "Americans with Disabilities Act"; and International Building Code for plumbing fixtures for people with disabilities.
- C. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.
- D. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- E. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.
- F. Comply with the following applicable standards and other requirements specified for plumbing fixtures:
 - 1. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.
 - 2. Porcelain-Enameled, Formed-Steel Fixtures: ASME A112.19.4M.
 - 3. Solid-Surface-Material Lavatories and Sinks: ANSI/ICPA SS-1.
 - 4. Stainless-Steel Residential Sinks: ASME A112.19.3.
 - 5. Vitreous-China Fixtures: ASME A112.19.2M.
 - 6. Water-Closet, Flush Valve, Tank Trim: ASME A112.19.5.
 - 7. Water-Closet, Flushometer Tank Trim: ASSE 1037.
- G. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:
 - 1. Backflow Protection Devices for Faucets with Side Spray: ASME A112.18.3M.

2. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.
3. Diverter Valves for Faucets with Hose Spray: ASSE 1025.
4. Faucets: ASME A112.18.1.
5. Hose-Connection Vacuum Breakers: ASSE 1011.
6. Hose-Coupling Threads: ASME B1.20.7.
7. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
8. NSF Potable-Water Materials: NSF 61.
9. Pipe Threads: ASME B1.20.1.
10. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
11. Supply Fittings: ASME A112.18.1.
12. Brass Waste Fittings: ASME A112.18.2.
- H. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:
 1. Atmospheric Vacuum Breakers: ASSE 1001.
 2. Brass and Copper Supplies: ASME A112.18.1.
 3. Manual-Operation Flushometers: ASSE 1037.
 4. Plastic Tubular Fittings: ASTM F 409.
 5. Brass Waste Fittings: ASME A112.18.2.
 6. Sensor-Operation Flushometers: ASSE 1037 and UL 1951.
- I. Comply with the following applicable standards and other requirements specified for miscellaneous components:
 1. Off-Floor Fixture Supports: ASME A112.6.1M.
 2. Pipe Threads: ASME B1.20.1.
 3. Plastic Toilet Seats: ANSI Z124.5.
 4. Supply and Drain Protective Shielding Guards: ICC A117.1.

PART 2 - PRODUCTS

2.1 LAVATORY FAUCETS

- A. Basis of Design Product: As shown on Drawings.
- B. Comparable Products by: Chicago Faucets, Delta Faucet Company, Moen, Inc., Speakman Company T & S Brass and Bronze Works, Inc.
- C. Description: Single-control mixing, Single-control nonmixing, or Two-handle mixing valve as shown on Drawings. Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.
- D. Characteristics: Equivalent to Basis of Design Product, and as described on Drawings.

2.2 SINK FAUCETS

- A. Basis of Design Product: As shown on Drawings.
- B. Comparable Products by: Chicago Faucets, Kohler Co., Moen, Inc., Royal Brass Mfg. Co., T & S Brass and Bronze Works, Inc.
- C. Characteristics: Equivalent to Basis of Design Product, and as described on Drawings.

2.3 FLUSHOMETERS

- A. Basis of Design Product: As shown on Drawings.
- B. Comparable Products by: Delany Co., Sloan Valve Company, Zurn Plumbing Products Group; Commercial Brass Operation.
- C. Characteristics: Equivalent to Basis of Design Product, and as described on Drawings.

2.4 TOILET SEATS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following: American Standard Companies, Inc.; Bemis Manufacturing Company; Centoco Manufacturing Corp.; Church Seats; Eljer; Kohler Co.; Olsonite Corp.; Sanderson Plumbing Products, Inc.; Beneke Div.; Sperzel.
- B. Description: Toilet seat for water-closet-type fixture. Molded, solid plastic with antimicrobial agent. Configuration, size, hinge type, color, as described on Drawings, equivalent to Basis of Design Product. Heavy-duty commercial class.

2.5 PROTECTIVE SHIELDING GUARDS

- A. Protective Shielding Pipe Covers:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. McGuire Manufacturing Co., Inc.
 - b. TRUEBRO, Inc.
 - c. Zurn Plumbing Products Group; Tubular Brass Plumbing Products Operation.
2. Description: Manufactured plastic wraps for covering plumbing fixture hot-water supply and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

2.6 FIXTURE SUPPORTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Josam Company.
 2. MIFAB Manufacturing Inc.
 3. Smith, Jay R. Mfg. Co.
 4. Tyler Pipe; Wade Div.
 5. Watts Drainage Products Inc.; a div. of Watts Industries, Inc.
 6. Zurn Plumbing Products Group; Specification Drainage Operation.
- B. Water-Closet Supports,:
1. Description: Combination carrier designed for accessible or standard mounting height of wall-mounting, water-closet-type fixture. Include single or double, vertical or horizontal, hub-and-spigot or hubless waste fitting as required for piping arrangement; faceplates; couplings with gaskets; feet; and fixture bolts and hardware matching fixture. Include additional extension coupling, faceplate, and feet for installation in wide pipe space.
- C. Urinal Supports,:
1. Description: Type I, urinal carrier with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture for wall-mounting, urinal-type fixture. Include steel uprights with feet.
 2. Accessible-Fixture Support: Include rectangular steel uprights.
- D. Lavatory Supports,:
1. Description: Type II, lavatory carrier with concealed arms and tie rod for wall-mounting, lavatory-type fixture. Include steel uprights with feet.
 2. Accessible-Fixture Support: Include rectangular steel uprights.
- E. Sink Supports,:
1. Description: Type II, sink carrier with hanger plate, bearing studs, and tie rod for sink-type fixture. Include steel uprights with feet.

2.7 WATER CLOSETS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
- a. American Standard Companies, Inc.
 - b. Kohler Co.
 - c. Sloan
 - d. Zurn
- B. Description: Equal to Basis of Design Product, and as otherwise described on Drawings.

2.8 URINALS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
- a. American Standard Companies, Inc.
 - b. Kohler Co.
 - c. Sloan
 - d. Zurn
- B. Description: Equal to Basis of Design Product, and as otherwise described on Drawings.

2.9 LAVATORIES

- A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
- a. American Standard Companies, Inc.
 - b. Kohler Co.
 - c. Sloan
 - d. Zurn
- B. Description: Equal to Basis of Design Product, and as otherwise described on Drawings.

2.10 SINKS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - 1. Elkay
 - 2. Just
 - 3. Sterling
- B. Description: Equal to Basis of Design Product, and as otherwise described on Drawings.

2.11 SERVICE SINKS

- A. Floor-mounted, molded stone mop basins.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Crane Plumbing, L.L.C./Fiat Products.
 - b. Florestone Products Co., Inc.
 - 2. Description: Equal to Basis of Design Product, and as otherwise described on Drawings.
 - 3. Accessories and Trim: As shown on Drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.
- B. Install off-floor supports, affixed to building substrate, for wall-mounting fixtures.
 - 1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
 - 2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
 - 3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.
- C. Install back-outlet, wall-mounting fixtures onto waste fitting seals and attach to supports.
- D. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.
- E. Install wall-mounting fixtures with tubular waste piping attached to supports.
- F. Install fixtures level and plumb according to roughing-in drawings.
- G. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.
- H. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.
- I. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.
- J. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.
- K. Install tanks for accessible, tank-type water closets with lever handle mounted on wide side of compartment.
- L. Install toilet seats on water closets.
- M. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- N. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.
- O. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- P. Install shower flow-control fittings with specified maximum flow rates in shower arms.
- Q. Install traps on fixture outlets.
 - 1. Exception: Omit trap on fixtures with integral traps.
 - 2. Exception: Omit trap on indirect wastes, unless otherwise indicated.
- R. Install escutcheons at piping wall and ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division 22 Section "Common Work Results for Plumbing."
- S. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

- A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.
- B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.
- C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.
- D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.
- E. Install fresh batteries in sensor-operated mechanisms.

3.4 PROTECTION

- A. Provide protective covering for installed fixtures and fittings.
- B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION

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SECTION 22 47 00 - WATER COOLERS

PART 1 - GENERAL

1.1 SUMMARY

1. This Section includes electric water coolers.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Operation and maintenance data.

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. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; for fixtures for people with disabilities.
- C. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- D. ARI Standard: Comply with ARI's "Directory of Certified Drinking Water Coolers" for style classifications.
- E. ARI Standard: Comply with ARI 1010, "Self-Contained, Mechanically Refrigerated Drinking-Water Coolers," for water coolers and with ARI's "Directory of Certified Drinking Water Coolers" for type and style classifications.
- F. ASHRAE Standard: Comply with ASHRAE 34, "Designation and Safety Classification of Refrigerants" for water coolers. Provide HFC 134a (tetrafluoroethane) refrigerant unless otherwise indicated.

PART 2 - PRODUCTS

2.1 ELECTRIC WATER COOLER

- A. Wall mounted barrier free electric water cooler with stainless steel basin, bi-level, accessible type with bottle filler, self-closing front and side mounted push bars, wall hanger and 1-1/4" tailpiece, characteristics as shown on Drawings. Color to be selected by Architect/Engineer from manufacturers standard color selection.
- B. Basis of Design Product: As shown on Drawings.
- C. Comparable products by Elkay, Oasis, Halsey-Taylor.
- D. Trap: 1-1/4"x1-1/4" 17 ga. cast brass trap.
- E. Stop/Supply: 1/2" ball valve with 1/2" riser (concealed).

2.2 FIXTURE SUPPORTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Josam Co.
 2. MIFAB Manufacturing, Inc.
 3. Smith, Jay R. Mfg. Co.
 4. Tyler Pipe; Wade Div.
 5. Watts Drainage Products Inc.; a div. of Watts Industries, Inc.
 6. Zurn Plumbing Products Group; Specification Drainage Operation.
- B. Description: ASME A112.6.1M, water cooler carriers. Include vertical, steel uprights with feet and tie rods and bearing plates with mounting studs matching fixture to be supported.
 1. Type I: Hanger-type carrier with two vertical uprights.
 2. Type II: Bilevel, hanger-type carrier with three vertical uprights.
 3. Supports for Accessible Fixtures: Include rectangular, vertical, steel uprights instead of steel pipe uprights.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Use carrier off-floor supports for wall-mounting fixtures, unless otherwise indicated.
- B. Set freestanding and pedestal drinking fountains on floor.
- C. Use chrome-plated brass or copper tube, fittings, and valves in locations exposed to view.

3.2 INSTALLATION

- A. Install off-floor supports affixed to building substrate and attach wall-mounting fixtures, unless otherwise indicated.
- B. Install fixtures level and plumb. For fixtures indicated for children, install at height required by authorities having jurisdiction.
- C. Install water-supply piping with shutoff valve on supply to each fixture to be connected to water distribution piping. Use ball, gate, or globe valve. Install valves in locations where they can be easily reached for operation. Valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
- D. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.
- E. Install pipe escutcheons at wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding pipe fittings. Escutcheons are specified in Division 22 Section "Common Work Results for Plumbing."
- F. Seal joints between fixtures and walls and floors using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."

3.3 CONNECTIONS

- A. Connect fixtures with water supplies, traps, and risers, and with soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- C. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

- A. Water Cooler Testing: After electrical circuitry has been energized, test for compliance with requirements. Test and adjust controls and safeties.
 - 1. Remove and replace malfunctioning units and retest as specified above.
 - 2. Report test results in writing.

3.5 ADJUSTING

- A. Adjust fixture flow regulators for proper flow and stream height.
- B. Adjust water cooler temperature settings.

END OF SECTION

SECTION 23 00 00 - GENERAL REQUIREMENTS FOR HVAC WORK

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for the installation of HVAC work.

1.2 SCOPE

- A. Provide all labor, materials, tools, equipment, and transportation, and perform all operations necessary for and reasonably incidental to proper execution and completion of all "HVAC" work, whether specifically mentioned or not, all as indicated, specified herein, and/or implied thereby to carry out the apparent intent.
 - 1. These drawings may be superseded by later revised or detailed drawings, specifications, or sketches prepared by the Designer, as needed for clarification, and this Contractor shall conform to all reasonable coordination requests.
 - 2. All items not specifically mentioned in the specifications or noted on the drawings, but which obviously are required to make the working installation complete, shall be included automatically.
 - 3. For projects which are bid or awarded as Single Prime contracts, organization of the Specifications into divisions, sections, and articles, and arrangement of the Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be done by any trade, unless specifically shown or noted otherwise.

1.3 PERMITS & FEES

- A. This Contractor shall secure all permits required for the completion of this contract. He shall obtain and deliver to the Owner all certificates of inspection issued by the authorities having jurisdiction.

1.4 VISIT TO JOB SITE

- A. Before submitting a bid, this Contractor shall visit the job site for the purpose of thoroughly examining the site and conditions under which the work must be performed.
- B. The submission of a bona fide bid will be construed to mean that this Contractor understands and is satisfied with conditions under which the contract must be fulfilled.
- C. No extra compensation will be allowed for situations arising from failure of this Contractor to be thoroughly familiar with site conditions, including charges and requirements for connection to utilities as shown for this project.

1.5 WORKMANSHIP

- A. Workmanship in the fabrication, preparation, and installation of materials and equipment shall conform to the best standards of practice of the trades involved.
- B. Work shall be performed by experienced and skilled mechanics under the supervision of a competent foreman.
- C. Substandard workmanship will be cause for rejection of work and replacement by Contractor.
- D. The Contractor shall reimburse the Designer for all costs incurred by the Designer due to Contractor's substandard or non-conforming work.

1.6 DRAWINGS AND SPECIFICATIONS

- A. The drawings show the location and arrangement of ducts, piping, grilles and diffusers, and equipment, together with details of connections of certain principal items.
- B. The layout shown shall be followed as closely as circumstances will permit, but this Contractor shall lay out their work to avoid conflict with other Contractors and trades, and to avoid any unnecessary cutting or damage to walls, floors, and supporting structural members.
- C. They shall, therefore, carefully, and accurately locate all sleeves and install at the proper time all necessary hangers, inserts, etc., which will be required for the completion of their work and shall be solely responsible for the accurate and proper location of above items.
- D. This Contractor shall refer to architectural, plumbing, and electrical drawings and shall cooperate fully with other Contractors and trades while installing piping, ducts, and other equipment because of close space limits. In case of conflict, notify Designer before proceeding with installation.
- E. Refer to architectural drawings for exact building dimensions and location of partition walls, doors, chases, etc.
 - 1. HVAC drawings are not to be scaled for such dimensions.
- F. The drawings and specifications complement each other and together are intended to give a complete description of the work.
 - 1. Any item of equipment or note of work to be done as shown on plans and not mentioned in the specifications, or mentioned in specifications and not shown in plans, shall be furnished the same as if mentioned or shown in both places.
 - 2. If conflicts exist, then the most stringent method shown or described shall apply.

- G. Any switches, controls, or equipment included in this contract work (drawings and/or specifications) that are not specifically shown on drawings shall be located for convenient use and access.
- H. Contractor shall coordinate all equipment arrangement and lay-out in field prior to beginning any actual installation of his work.
 - 1. If Contractor notes any discrepancy, omission, or conflict found in plans or specifications, he shall call to the immediate attention of the Designer, prior to receipt of bids.
- I. It is the intention that piping, air ducts and light fixtures are designed and laid out to clear each other.
 - 1. It shall be the responsibility of this Contractor to coordinate his work with that of other trades to avoid any such conflicts.
 - 2. Any conflicts that occur after work of one trade is installed and was not prior coordinated shall be relocated or rearranged at the total expense of this Contractor, as directed by Designer.
 - 3. Any conflicts that cannot be corrected in field by relocation or elevation changes shall be reported to the Designer in writing prior to any installation.
- J. The drawings are not intended to show every complete or accurate detail.
 - 1. Because of the small scale of HVAC drawings, it is not possible to indicate all offsets, fittings, and accessories which may be required.
 - 2. Investigate structural and finish conditions affecting this work and arrange work accordingly, providing such fittings and accessories that may be required to meet the conditions.

1.7 ALLOWANCE FOR ADDED WORK

- A. Before proceeding with any work for which compensation may be claimed or the owner may claim credit, a detailed estimate shall first be submitted and approved in writing.
- B. No claim for addition to the contract sum will be valid unless so ordered and approved by the Owner and Designer prior to the start of work.
- C. Any conflicts corrected by relocation or elevation changes do not constitute extra work.

1.8 INCIDENTAL CONSTRUCTION WORK

- A. All blocking for openings for piping or ducts in concrete floors, masonry walls or partitions shall be provided by this Contractor.
- B. This Contractor shall do all cutting and fitting of their work and of other work that may be required to make the several parts come together properly and to fit their work to

receive or be received by the work of other Contractors as shown upon, or reasonably implied by the drawings and specifications.

- C. They shall properly complete and finish up his work after other Contractors have finished as the Designer may direct.
- D. All excavating required for the installation of this system shall be done by this Contractor.
 - 1. Backfill shall be accomplished as specified in appropriate section of specifications.
- E. This Contractor shall furnish all sleeves in floors, beams, walls, etc., for each such penetration as needed for installing their work and installation of sleeves by General Contractor.
- F. Unless otherwise noted, the General Contractor will provide openings and lintels as new construction progresses, but this Contractor shall fully designate his requirements prior to construction.
 - 1. Failure to furnish his requirements prior to building construction and failure to coordinate his work with the building construction shall make this Contractor responsible for removing, replacing, and painting building construction as required for installation of his work.

1.9 SUPERVISION

- A. This Contractor shall always have in charge of the work during construction a thoroughly competent foreman with extensive experience in the work to be performed under this contract.
 - 1. Anyone deemed not capable by the Designer shall be replaced immediately upon request, and after satisfactory foreman has been assigned, he shall not be withdrawn without the written consent of the Designer.

1.10 ELECTRICAL WORK BY OTHERS

- A. Refer to the drawings for the details of locations of circuit breakers, junction boxes, disconnect switches, conduits and slack wire required where this contractor's electrical work terminates and electrical work by others begin.
- B. The Electrical Contractor shall furnish and install all power circuits for equipment furnished by others.
- C. In Mechanical Rooms the wiring by the Electrical Contractor shall generally terminate in a power wiring gutter, line side of disconnect switches or starters, junction box, or electrical panel.

1. From these points power wiring to the equipment furnished by the HVAC Contractor shall generally be by the HVAC Contractor.
- D. Power wiring to mechanical equipment outside equipment rooms will generally be run by the Electrical Contractor to line side of a disconnect switch or junction box in the vicinity (within 3'-0") of the plumbing equipment.
 1. Power wiring from that point to the equipment will be by the HVAC Contractor.

1.11 EXISTING FACILITIES

- A. In existing facilities, disruption of operations must be kept to a minimum and coordinated with Owner.
- B. Work in existing buildings must be cleaned up daily immediately after finishing that portion of work and equipment left in order for Owner to continue operations.
- C. When it is necessary to interrupt utility services in the fulfillment of this contract, such interruptions shall be kept to a minimum and coordinated with Owner.
 1. Once work has begun, it shall be pursued diligently until completed.
- D. Every precaution shall be taken to prevent damage to existing underground lines and structures and public utilities.
 1. Damage to existing water and sewer lines, culverts, service connections, underground cables, and similar surface and sub-surface structures shall be at the risk of this Contractor, whether or not locations thereof are shown on plans, and the repairing of such damage shall be by this Contractor and shall be completed without delay.
 2. Compensation for such repairs shall be based on normal and reasonable costs.
- E. The locations of any existing underground utilities that are shown are in an approximate way only and have not been independently verified by the Owner or its representative.
 1. The Contractor shall determine the exact location of all existing utilities before commencing work and agrees to be fully responsible for all damages which might be occasioned by the Contractor's failure to exactly locate and preserve all underground utilities.

1.12 ADAPTION OF WORK TO EXISTING CONDITIONS

- A. It is reasonably implied that this Contractor is to furnish all labor and materials to provide Owner with a new and satisfactory system in these facilities.
- B. Contractor is to include necessary work for adaptation of equipment to conditions that may be found to produce conflicts during construction.

1. When any such conditions are encountered, this Contractor is to consult with Designer and then modify installation as directed without additional costs, and to include any incidental materials required.

1.13 HVAC SYSTEM USE DURING CONSTRUCTION

- A. The permanent HVAC system may be used during construction to control temperature and relative humidity when allowed by the General Conditions, Supplementary General Conditions, or elsewhere in the Contract Documents, and approved by the Designer.
- B. Such use shall be subject to compliance with SMACNA "IAQ Guideline for Occupied Buildings under Construction" and the following guidelines.
- C. The building's permanent HVAC system is designed to provide comfort conditions in accordance with ASHRAE standards in the completed and occupied facility.
 1. The system may or may not be designed to provide for dehumidification or other special control sequences.
 2. The Designer does not warrant use of the system during construction for drying out concrete slabs or similar construction operations; such use is solely at the discretion of the Contractor.
- D. For approval to use the permanent system during construction submit to the Owner and Designer:
 1. Construction indoor-air-quality management plan, describing Contractor's means and methods for intended use of the building permanent HVAC system.
 2. Product data for temporary filtration media.
- E. During construction, submit the following Construction Documentation.
 1. Six photographs at three different times during the construction period, along with a brief description of the SMACNA approach employed, documenting implementation of the indoor-air-quality management measures, such as protection of ducts and on-site stored or installed absorptive materials.
 2. Signed statement describing the building air flush-out procedures including the dates when flush-out was begun and completed and statement that filtration media was replaced after flush-out.
 3. Report from testing and inspecting agency indicating results of indoor-air-quality testing and documentation showing compliance with indoor-air-quality testing procedures and requirements.
- F. If Owner authorizes use of permanent heating, cooling, and ventilating systems during construction period, install filter media having a MERV 8 according to ASHRAE 52.2 at each return-air inlet for the air-handling system used during construction.
 1. Replace all air filters as required, but not less than weekly, during operation and immediately prior to occupancy.

G. Building Flush Out

1. After construction ends, prior to occupancy and with all interior finishes installed, perform a building flush-out by supplying a total volume of 14000 cu. ft. of outdoor air per sq. ft. of floor area while maintaining an internal temperature of at least 60 deg F and a relative humidity no higher than 60 percent.
2. Conduct baseline indoor-air-quality testing, after construction ends and prior to occupancy, using testing protocols consistent with the EPA's "Compendium of Methods for the Determination of Air Pollutants in Indoor Air," and as additionally detailed in the USGBC's "LEED for Schools Reference Guide."

H. Use of the permanent HVAC system during Construction shall not in any way affect warranty start dates established in the General Conditions, Supplementary General Conditions, or elsewhere in the Specifications.

I. Contractor shall clean ducts, air handling equipment, heating and cooling coils, grilles and diffusers, and any other equipment as necessary prior to Final Acceptance, to provide the Owner a complete operating system in new and clean condition.

1.14 LEED PROJECTS

A. The HVAC Contractor and sub-tier Contractors shall bare the responsibility for applicable portions of work as they pertain to requirements for LEED certification, shall coordinate with other trades as required for LEED certification, and demonstrate proof of compliance for LEED certification.

B. The HVAC Contractor shall provide the project team a LEED Project Representative for the mechanical systems to participate in LEED Project Management and Coordination.

1. The following shall be provided.
 - a. Construction Indoor Air Quality (IAQ) Management Plan.
 - b. HVAC&R Refrigerant Waste Disposal Plan.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

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SECTION 23 05 13 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 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.

1.2 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.

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. Rotor: Random-wound, squirrel cage.
- F. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- G. Temperature Rise: Match insulation rating.
- H. Insulation: Class F.
- I. 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.
- J. 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.

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

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SECTION 23 05 17 - SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sleeves.
2. Sleeve-seal systems.
3. Grout.
4. 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.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to 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, anti-corrosion coated or zinc coated, with plain ends and integral welded waterstop collar.

- D. Galvanized-Steel Sheet Pipe Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- E. PVC Pipe Sleeves: ASTM D1785, Schedule 40.

2.2 SLEEVE-SEAL SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. Advance Products & Systems, Inc.
 - 2. CALPICO, Inc.
 - 3. GPT; an EnPro Industries company.
- B. 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: Stainless steel, Type 316.
 - 5. Connecting Bolts and Nuts: Stainless steel, Type 316, of length required to secure pressure plates to sealing elements.

2.3 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.

2.4 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. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

- a. GE Construction Sealants; Momenive Performance Materials Inc.
 - b. Permathane®/Acryl-R®; ITW Polymers Sealants North America.
 - c. The Dow Chemical Company.
- 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.

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.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
 - 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 above finished floor level.
 - 2. 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 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.

3.3 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.

3.4 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: Steel-pipe sleeves.
 - b. Piping NPS 6 and Larger: Steel-pipe sleeves.
 - 2. Exterior Concrete Walls Below Grade:
 - a. Piping Smaller Than NPS 6: 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.
 - b. Piping NPS 6 and Larger: Steel-pipe sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch Insert dimension annular clear space between piping and sleeve for installing sleeve-seal system.
 - 3. Concrete Slabs-on-Grade:
 - a. Piping Smaller Than NPS 6: Steel-pipe sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch Insert dimension annular clear space between piping and sleeve for installing sleeve-seal system.

- b. Piping NPS 6 and Larger: Steel-pipe sleeves with 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: Galvanized-steel pipe sleeves.
 - b. Piping NPS 6 and Larger: Galvanized-steel sheet sleeves.

END OF SECTION

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SECTION 23 05 18 - ESCUTCHEONS FOR HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Escutcheons.
 - 2. Floor plates.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. Keeney Manufacturing Company (The).
 - 2. Mid-America Fittings, Inc.
 - 3. 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, Deep-Pattern Type: Deep-drawn, box-shaped steel with polished, chrome-plated finish and spring-clip fasteners.
- C. One-Piece, Stamped-Steel Type: With polished, chrome-plated finish and spring-clip fasteners.
- D. 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: 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 steel or split-plate steel with polished, chrome-plated finish.
 - c. Insulated Piping: One-piece steel with polished, chrome-plated finish.
 - d. Insulated Piping: One-piece stamped steel or split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
 - e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece steel with polished, chrome-plated finish.
 - f. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece stamped steel or split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
 - g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece steel with polished, chrome-plated finish.
 - h. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece stamped steel or split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
 - 2. Escutcheons for Existing Piping to Remain:
 - a. Chrome-Plated Piping: Split-plate, stamped steel with concealed or exposed-rivet hinge with polished, chrome-plated finish.
 - b. Insulated Piping: Split-plate, stamped steel with concealed or exposed-rivet hinge with polished, chrome-plated finish.
 - c. 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.
 - d. Bare Piping at Ceiling Penetrations in Finished Spaces: 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 and Relocated Existing 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

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SECTION 23 05 29 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Thermal-hanger shield inserts.
4. Fastener systems.
5. 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 23 05 16 "Expansion Fittings and Loops for HVAC Piping" for pipe guides and anchors.
3. Section 23 31 13 "Metal Ducts" and Section 23 31 16 "Nonmetal Ducts" for duct hangers and supports.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Trapeze pipe hangers.
2. 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.

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.4 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.
- B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
 - 1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
 - 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
 - 3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

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 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 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.

2.5 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, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.6 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.7 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 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. 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 strut 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. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- I. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- J. 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.
- K. Install lateral bracing with pipe hangers and supports to prevent swaying.
- L. 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.
- M. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- N. 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.

O. 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. 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 metal trapeze pipe hangers and metal framing systems and attachments for general service applications.
- F. Use stainless-steel pipe hangers and fiberglass pipe hangers 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-joint 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. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION

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SECTION 23 05 48.13 - VIBRATION CONTROLS FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Elastomeric isolation pads.
2. Elastomeric isolation mounts.
3. Restrained elastomeric isolation mounts.
4. Open-spring isolators.
5. Housed-spring isolators.
6. Restrained-spring isolators.
7. Housed-restrained-spring isolators.
8. Pipe-riser resilient support.
9. Resilient pipe guides.
10. Elastomeric hangers.
11. Spring hangers.
12. Snubbers.
13. Restraints - rigid type.
14. Restraints - cable type.
15. Restraint accessories.
16. Post-installed concrete anchors.
17. Concrete inserts.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Detail fabrication and assembly of equipment bases.
2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Field quality-control reports.

1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct testing indicated, be an NRTL as defined by OSHA in 29 CFR 1910.7 and be acceptable to authorities having jurisdiction.
- B. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

2.2 ELASTOMERIC ISOLATION PADS

- A. Elastomeric Isolation Pads:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Kinetics Noise Control, Inc.
 - b. VMC GROUP.
 - c. Vibration Isolation.
 - 2. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.
 - 3. Size: Factory or field cut to match requirements of supported equipment.
 - 4. Minimum deflection as indicated on Drawings.
 - 5. Pad Material: Oil- and water-resistant rubber.

2.3 ELASTOMERIC ISOLATION MOUNTS

- A. Elastomeric Isolation Mounts:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Kinetics Noise Control, Inc.
 - b. VMC GROUP.
 - c. Vibration Isolation.
 - 2. Mounting Plates:
 - a. Top Plate: Encapsulated steel load transfer top plates, factory drilled and threaded.

- b. Baseplate: Encapsulated steel bottom plates with holes provided for anchoring to support structure.
3. Minimum deflection as indicated on Drawings.
4. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

2.4 OPEN-SPRING ISOLATORS

A. Freestanding, Laterally Stable, Open-Spring Isolators:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Kinetics Noise Control, Inc.
 - b. VMC GROUP.
 - c. Vibration Isolation.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Baseplates: Factory-drilled steel plate for bolting to structure with an elastomeric isolator pad attached to the underside. Baseplates shall limit floor load to 500 psi.
7. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.
8. Minimum deflection as indicated on Drawings.

2.5 HOUSED-SPRING ISOLATORS

A. Freestanding, Laterally Stable, Open-Spring Isolators in Two-Part Telescoping Housing:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Kinetics Noise Control, Inc.
 - b. VMC GROUP.
 - c. Vibration Isolation.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Minimum deflection as indicated on Drawings.

7. Two-Part Telescoping Housing: A steel top and bottom frame separated by an elastomeric material and enclosing the spring isolators.
 - a. Drilled base housing for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psi.

2.6 SPRING HANGERS

- A. Combination Coil-Spring and Elastomeric-Insert Hanger with Spring and Insert in Compression:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Kinetics Noise Control, Inc.
 - b. VMC GROUP.
 - c. Vibration Isolation.
 2. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
 3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 6. Minimum deflection as indicated on Drawings.
 7. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 8. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
 9. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
 10. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

2.7 RESTRAINTS - RIGID TYPE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Cooper B-line; brand of Eaton, Electrical Sector.
 2. Hilti, Inc.
 3. Unistrut; Atkore International.
- B. Description: Shop- or field-fabricated bracing assembly made of AISI S110-07-S1 slotted steel channels, ANSI/ASTM A53/A53M steel pipe as per NFPA 13, or other rigid steel brace member. Includes accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; rated in tension, compression, and torsion forces.

2.8 RESTRAINTS - CABLE TYPE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Cooper B-line; brand of Eaton, Electrical Sector.
 2. Gripple Inc.
 3. VMC GROUP.
- B. Restraint Cables: ASTM A492 stainless steel cables. End connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; with fittings attached by means of poured socket, swaged socket, or mechanical (Flemish eye) loop.

2.9 RESTRAINT ACCESSORIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Cooper B-line; brand of Eaton, Electrical Sector.
 2. Hilti, Inc.
 3. Mason Industries, Inc.
 4. Unistrut; Atkore International.
- B. Hanger-Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.
- C. Hinged and Swivel Brace Attachments: Multifunctional steel connectors for attaching hangers to rigid channel bracings and restraint cables.
- D. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.
- E. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices used.
- F. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

2.10 POST-INSTALLED CONCRETE ANCHORS

- A. Mechanical Anchor Bolts:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cooper B-line; brand of Eaton, Electrical Sector.

- b. [Hilti, Inc.](#)
 - c. [Mason Industries, Inc.](#)
 - d. [Unistrut; Atkore International.](#)
2. Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength for anchor and as tested according to ASTM E488/E488M.

2.11 CONCRETE INSERTS

- A. [Manufacturers:](#) Subject to compliance with requirements, provide products by one of the following:
 1. [Cooper B-line; brand of Eaton, Electrical Sector.](#)
 2. [Hilti, Inc.](#)
 3. [Mason Industries, Inc.](#)
- B. Provide preset concrete inserts that are prequalified in accordance with ICC-ES AC466 testing.
- C. Comply with ANSI/MSS SP-58.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an evaluation service member of ICC-ES.
- B. Hanger-Rod Stiffeners: Install hanger-rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to wind-load forces.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength is adequate to carry static and wind force loads within specified loading limits.

3.2 INSTALLATION OF VIBRATIONCONTROL DEVICES

- A. Provide vibrationcontrol devices for systems and equipment where indicated in Equipment Schedules or Vibration-Control Device Schedules on Drawings, where Specifications indicate they are to be installed on specific equipment and systems, and where required by applicable codes.
- B. Coordinate location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 03 30 00 "Cast-in-Place Concrete."

- C. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.
- D. Comply with requirements in Section 07 72 00 "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.
- E. Equipment Restraints:
 - 1. Install snubbers on HVAC equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
 - 2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
- F. Piping Restraints:
 - 1. Comply with requirements in MSS SP-127.
- G. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
- H. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
- I. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
- J. Post-Installed Concrete Anchors:
 - 1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
 - 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
 - 3. Wedge-Type Anchor Bolts: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
 - 4. Set anchors to manufacturer's recommended torque, using a torque wrench.
 - 5. Install zinc-coated steel anchors for interior and stainless steel anchors for exterior applications.

3.3 ACCOMMODATION OF DIFFERENTIAL MOTION

- A. Provide flexible connections in piping systems where they cross structural joints and other point where differential movement may occur. Provide adequate flexibility to

accommodate differential movement as determined in accordance with ASCE/SEI 7. Comply with requirements in Section 23 21 13 "Hydronic Piping" and Section 23 21 16 "Hydronic Piping Specialties" for piping flexible connections.

3.4 ADJUSTING

- A. Adjust isolators after system is at operating weight.
- B. Adjust limit stops on restrained-spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

3.5 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. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
 - 2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
 - 3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
 - 4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
 - 5. Test to 90 percent of rated proof load of device.
 - 6. Measure isolator restraint clearance.
 - 7. Measure isolator deflection.
 - 8. Verify snubber minimum clearances.
- D. Remove and replace malfunctioning units and retest as specified above.
- E. Prepare test and inspection reports.

END OF SECTION

SECTION 23 05 53 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Equipment labels.
 - 2. Warning signs and labels.
 - 3. Pipe labels.
 - 4. Duct labels.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Metal Labels for Equipment:
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Brady Corporation.
 - b. Craftmark Pipe Markers.
 - c. Marking Services, Inc.
 - d. Seton Identification Products.
 - 2. Material and Thickness: aluminum, 0.032-inch or anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
 - 3. Letter Color: Black.
 - 4. Background Color: White.
 - 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.

B. Plastic Labels for Equipment:

1. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Brady Corporation.
 - b. Craftmark Pipe Markers.
 - c. Marking Services, Inc.
 - d. Seton Identification Products.
2. **Material and Thickness:** Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
3. **Letter Color:** Black.
4. **Background Color:** White.
5. **Maximum Temperature:** Able to withstand temperatures up to 160 deg F.
6. **Minimum Label Size:** Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
7. **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.
8. **Fasteners:** Stainless-steel rivets or self-tapping screws.
9. **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. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Brady Corporation.
 2. Craftmark Pipe Markers.
 3. Marking Services Inc.
 4. Seton Identification Products.

- B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
- C. Letter Color: Black.
- D. Background Color: White.
- E. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- F. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- G. 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.
- H. Fasteners: Stainless-steel rivets or self-tapping screws.
- I. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- J. Label Content: Include caution and warning information plus emergency notification instructions.

2.3 PIPE LABELS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Brady Corporation.
 - 2. Craftmark Pipe Markers.
 - 3. Marking Seivics Inc.
 - 4. Seton Identification Products.
- B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction according to ASME A13.1.
- C. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.
- D. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- E. 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.

2.4 DUCT LABELS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Brady Corporation.
 2. Craftmark Pipe Markers.
 3. Seton Identification Products.
- B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
- C. Letter Color: Black.
- D. Background Color: White.
- E. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- F. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- G. 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.
- H. Fasteners: Stainless-steel rivets or self-tapping screws.
- I. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- J. 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.

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 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

- A. 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.
- B. Pipe Label Color Schedule:
 - 1. Chilled-Water Piping: Black letters on a safety-orange background.
 - 2. Condenser-Water Piping: Black letters on a safety-orange background.
 - 3. Heating Water Piping: Black letters on a safety-orange background.
 - 4. Refrigerant Piping: Black letters on a safety-orange background.
 - 5. Low-Pressure Steam Piping: White letters on a safety-black background.
 - 6. High-Pressure Steam Piping: White letters on a safety-black background.
 - 7. Steam Condensate Piping: White letters on a safety-gray background.

3.4 DUCT LABEL INSTALLATION

- A. Install 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. 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.

END OF SECTION

SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Testing, Adjusting, and Balancing of Air Systems:
 - a. Constant-volume air systems.
 - b. Variable-air-volume systems.
2. Testing, adjusting, and balancing of equipment.
3. Procedures for exhaust hoods.
4. Duct leakage tests verification.
5. HVAC-control system verification.

1.2 DEFINITIONS

- A. AABC: Associated Air Balance Council.
- B. NEBB: National Environmental Balancing Bureau.
- C. TAB: Testing, adjusting, and balancing.
- D. TABB: Testing, Adjusting, and Balancing Bureau.
- E. TAB Specialist: An independent entity meeting qualifications to perform TAB work.
- F. TDH: Total dynamic head.

1.3 ACTION SUBMITTALS

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
- B. Contract Documents Examination Report: Within 30 days of Contractor's Notice to Proceed, submit the Contract Documents review report, as specified in Part 3.
- C. Strategies and Procedures Plan: Within 60 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures, as specified in "Preparation" Article.

- D. System Readiness Checklists: Within 60 days of Contractor's Notice to Proceed, submit system readiness checklists, as specified in "Preparation" Article.
- E. Examination Report: Submit a summary report of the examination review required in "Examination" Article.
- F. Certified TAB reports.
- G. Sample report forms.
- H. Instrument calibration reports, to include the following:
 - 1. Instrument type and make.
 - 2. Serial number.
 - 3. Application.
 - 4. Dates of use.
 - 5. Dates of calibration.

1.5 QUALITY ASSURANCE

- A. TAB Specialists Qualifications, Certified by AABC:
 - 1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC.
 - 2. TAB Technician: Employee of the TAB specialist and certified by AABC.
- B. TAB Specialists Qualifications, Certified by NEBB or TABB:
 - 1. TAB Field Supervisor: Employee of the TAB specialist and certified by NEBB or TABB.
 - 2. TAB Technician: Employee of the TAB specialist and certified by NEBB or TABB.
- C. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."
- D. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.7.2.3 - "System Balancing."
- E. Code and AHJ Compliance: TAB is required to comply with governing codes and requirements of authorities having jurisdiction.

1.6 FIELD CONDITIONS

- A. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.
- B. Examine installed systems for balancing devices, such as test ports, gauge cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.
- C. Examine the approved submittals for HVAC systems and equipment.
- D. Examine design data, including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine ceiling plenums and underfloor air plenums used for HVAC to verify that they are properly separated from adjacent areas and sealed.
- F. Examine equipment performance data, including fan and pump curves.
 - 1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
 - 2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.
- G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- H. Examine test reports specified in individual system and equipment Sections.
- I. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.
- J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.

- K. Examine control valves for proper installation for their intended function of isolating, throttling, diverting, or mixing fluid flows.
- L. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- M. Examine system pumps to ensure absence of entrained air in the suction piping.
- N. Examine operating safety interlocks and controls on HVAC equipment.
- O. Examine control dampers for proper installation for their intended function of isolating, throttling, diverting, or mixing air flows.
- P. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

- A. Prepare a TAB plan that includes the following:
 - 1. Equipment and systems to be tested.
 - 2. Strategies and step-by-step procedures for balancing the systems.
 - 3. Instrumentation to be used.
 - 4. Sample forms with specific identification for all equipment.
- B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:
 - 1. Airside:
 - a. Verify that leakage and pressure tests on air distribution systems have been satisfactorily completed.
 - b. Duct systems are complete with terminals installed.
 - c. Volume, smoke, and fire dampers are open and functional.
 - d. Clean filters are installed.
 - e. Fans are operating, free of vibration, and rotating in correct direction.
 - f. Variable-frequency controllers' startup is complete and safeties are verified.
 - g. Automatic temperature-control systems are operational.
 - h. Ceilings are installed.
 - i. Windows and doors are installed.
 - j. Suitable access to balancing devices and equipment is provided.
 - 2. Hydronics:
 - a. Verify leakage and pressure tests on water distribution systems have been satisfactorily completed.
 - b. Piping is complete with terminals installed.
 - c. Water treatment is complete.

- d. Systems are flushed, filled, and air purged.
- e. Strainers are pulled and cleaned.
- f. Control valves are functioning in accordance with the sequence of operation.
- g. Shutoff and balance valves have been verified to be 100 percent open.
- h. Pumps are started and proper rotation is verified.
- i. Pump gauge connections are installed directly at pump inlet and outlet flanges or in discharge and suction pipe prior to valves or strainers.
- j. Variable-frequency controllers' startup is complete and safeties are verified.
- k. Suitable access to balancing devices and equipment is provided.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system in accordance with the procedures contained in AABC's "National Standards for Total System Balance" or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and in this Section.
- B. Cut insulation, ducts, pipes, and equipment casings for installation of test probes to the minimum extent necessary for TAB procedures.
 - 1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
 - 2. Where holes for probes are required in piping or hydronic equipment, install pressure and temperature test plugs to seal systems.
 - 3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish in accordance with Section 23 07 13 "Duct Insulation," Section 23 07 16 "HVAC Equipment Insulation," and Section 23 07 19 "HVAC Piping Insulation."
- C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 TESTING, ADJUSTING, AND BALANCING OF HVAC EQUIPMENT

- A. Test, adjust, and balance HVAC equipment indicated on Drawings, including, but not limited to, the following:
 - 1. Motors.
 - 2. Pumps.
 - 3. Fans and ventilators.
 - 4. Air curtains.
 - 5. Terminal units.
 - 6. Commercial kitchen hoods.
 - 7. Unit heaters.
 - 8. Condensing units.

9. Condensers.
10. Air-handling units.
11. Heating and ventilating units.
12. Rooftop air-conditioning units.
13. Heating-only makeup air units.
14. Packaged air conditioners.
15. Split-system air conditioners.
16. Variable-refrigerant-flow systems.
17. Heat pumps.

3.5 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' Record drawings duct layouts.
- C. For variable-air-volume systems, develop a plan to simulate diversity.
- D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.
- F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- G. Verify that motor starters are equipped with properly sized thermal protection.
- H. Check dampers for proper position to achieve desired airflow path.
- I. Check for airflow blockages.
- J. Check condensate drains for proper connections and functioning.
- K. Check for proper sealing of air-handling-unit components.

3.6 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
 1. Measure total airflow.
 - a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.

- b. Where duct conditions allow, measure airflow by main Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses close to the fan and prior to any outlets, to obtain total airflow.
 - c. Where duct conditions are unsuitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
 - 2. Measure fan static pressures as follows:
 - a. Measure static pressure directly at the fan outlet or through the flexible connection.
 - b. Measure static pressure directly at the fan inlet or through the flexible connection.
 - c. Measure static pressure across each component that makes up the air-handling system.
 - d. Report artificial loading of filters at the time static pressures are measured.
 - 3. Obtain approval from Engineer for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
 - 4. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload occurs. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.
- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows.
- 1. Measure airflow of submain and branch ducts.
 - 2. Adjust submain and branch duct volume dampers for specified airflow.
 - 3. Re-measure each submain and branch duct after all have been adjusted.
- C. Adjust air inlets and outlets for each space to indicated airflows.
- 1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
 - 2. Measure inlets and outlets airflow.
 - 3. Adjust each inlet and outlet for specified airflow.
 - 4. Re-measure each inlet and outlet after they have been adjusted.
- D. Verify final system conditions.
- 1. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to design if necessary.
 - 2. Re-measure and confirm that total airflow is within design.
 - 3. Re-measure all final fan operating data, speed, volts, amps, and static profile.
 - 4. Mark all final settings.
 - 5. Test system in economizer mode. Verify proper operation and adjust if necessary.
 - 6. Measure and record all operating data.
 - 7. Record final fan-performance data.

3.7 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

A. Adjust the variable-air-volume systems as follows:

1. Verify that the system static pressure sensor is located two-thirds of the distance down the duct from the fan discharge.
2. Verify that the system is under static pressure control.
3. Select the terminal unit that is most critical to the supply-fan airflow. Measure inlet static pressure, and adjust system static pressure control set point so the entering static pressure for the critical terminal unit is not less than the sum of the terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.
4. Calibrate and balance each terminal unit for maximum and minimum design airflow as follows:
 - a. Adjust controls so that terminal is calling for maximum airflow. Some controllers require starting with minimum airflow. Verify calibration procedure for specific project.
 - b. Measure airflow and adjust calibration factor as required for design maximum airflow. Record calibration factor.
 - c. When maximum airflow is correct, balance the air outlets downstream from terminal units.
 - d. Adjust controls so that terminal is calling for minimum airflow.
 - e. Measure airflow and adjust calibration factor as required for design minimum airflow. Record calibration factor. If no minimum calibration is available, note any deviation from design airflow.
 - f. On constant volume terminals, in critical areas where room pressure is to be maintained, verify that the airflow remains constant over the full range of full cooling to full heating. Note any deviation from design airflow or room pressure.
5. After terminals have been calibrated and balanced, test and adjust system for total airflow. Adjust fans to deliver total design airflows within the maximum allowable fan speed listed by fan manufacturer.
 - a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
 - b. Set terminals for maximum airflow. If system design includes diversity, adjust terminals for maximum and minimum airflow, so that connected total matches fan selection and simulates actual load in the building.
 - c. Where duct conditions allow, measure airflow by main Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses close to the fan and prior to any outlets, to obtain total airflow.
 - d. Where duct conditions are unsuitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
6. Measure fan static pressures as follows:

- a. Measure static pressure directly at the fan outlet or through the flexible connection.
 - b. Measure static pressure directly at the fan inlet or through the flexible connection.
 - c. Measure static pressure across each component that makes up the air-handling system.
 - d. Report any artificial loading of filters at the time static pressures are measured.
7. Set final return and outside airflow to the fan while operating at maximum return airflow and minimum outdoor airflow.
 - a. Balance the return-air ducts and inlets.
 - b. Verify that terminal units are meeting design airflow under system maximum flow.
8. Re-measure the inlet static pressure at the most critical terminal unit, and adjust the system static pressure set point to the most energy-efficient set point to maintain the optimum system static pressure. Record set point and give to controls Contractor.
9. Verify final system conditions as follows:
 - a. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to match design if necessary.
 - b. Re-measure and confirm that total airflow is within design.
 - c. Re-measure final fan operating data, speed, volts, amps, and static profile.
 - d. Mark final settings.
 - e. Test system in economizer mode. Verify proper operation and adjust if necessary. Measure and record all operating data.
 - f. Verify tracking between supply and return fans.

3.8 PROCEDURES FOR AIR-COOLED CONDENSING UNITS

- A. Verify proper rotation of fan(s).
- B. Measure and record entering- and leaving-air temperatures.
- C. Measure and record entering and leaving refrigerant pressures.
- D. Measure and record operating data of compressor(s), fan(s), and motors.

3.9 PROCEDURES FOR AIR-COOLED CONDENSERS

- A. Verify proper rotation of fan(s).
- B. Measure and record entering- and leaving-air temperatures.
- C. Measure and record entering and leaving refrigerant pressures.

- D. Measure and record operating data of fan(s) and motor(s).

3.10 PROCEDURES FOR EXHAUST HOODS

- A. Room Pressure: Measure and record room pressure with respect to atmosphere and adjacent space with hoods in room initially not operating and then with hoods operating.
- B. Makeup Air: Systems supplying source of makeup air to hoods shall be in operation during testing and balancing of exhaust hoods.
 - 1. Measure and record temperature of makeup air entering hood. If hood makeup air is from multiple sources having different temperatures, measure and record the airflow and temperatures of each source and calculate the weighted average temperature.
 - 2. Use simulated smoke to observe supply air-distribution air patterns in vicinity of hoods. Consult with hood manufacturer and report conditions that have a detrimental effect on intended capture, containment, and other attributes effecting proper operation.
- C. Rooms with Multiple Hoods: Test each hood separately, one at a time, and repeat tests with all hoods intended to operate simultaneously by design.
- D. Canopy Hoods: Measure and record the following:
 - 1. Pressure drop across hood.
 - 2. Airflow by duct traverse where duct distribution will allow accurate measurement, and calculate hood average face velocity.
 - 3. Measure velocity across hood face and calculate hood airflow.
 - a. Clearly indicate the direction of flow at each point of measurement.
 - b. Measure velocity across opening on not less than 12-inch centers. Record velocity at each measurement, and calculate average velocity.
- E. Kitchen Hoods:
 - 1. Type 1: Measure and record pressure drop and face velocity of hood filters and slots in accordance with hood manufacturer's instructions. Consult hood manufacturer to determine hood airflow using recorded information.
 - 2. Type 2: Measure and record airflow by duct traverse.
 - 3. Capture and Containment: Check each hood for proper capture and containment using a smoke-emitting device. Observe and report performance. Make adjustments to achieve optimum results.
- F. AHJ Tests: Conduct additional tests required by authorities having jurisdiction.

3.11 DUCT LEAKAGE TESTS

- A. Witness the duct leakage testing performed by Installer.
- B. Verify that proper test methods are used and that leakage rates are within specified limits.
- C. Report deficiencies observed.

3.12 TOLERANCES

- A. Set HVAC system's airflow rates and water flow rates within the following tolerances:
 - 1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
 - 2. Air Outlets and Inlets: Plus or minus 10 percent.
- B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

3.13 PROGRESS REPORTING

- A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for system-balancing devices. Recommend changes and additions to system-balancing devices, to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance-measuring and -balancing devices.
- B. Status Reports: Prepare biweekly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.14 FINAL REPORT

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
 - 1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
 - 2. Include a list of instruments used for procedures, along with proof of calibration.
 - 3. Certify validity and accuracy of field data.
- B. Final Report Contents: In addition to certified field-report data, include the following:
 - 1. Fan curves.

2. Manufacturers' test data.
3. Field test reports prepared by system and equipment installers.
4. Other information relative to equipment performance; do not include Shop Drawings and Product Data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB specialist.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents, including the following:
 - a. Indicated versus final performance.
 - b. Notable characteristics of systems.
 - c. Description of system operation sequence if it varies from the Contract Documents.
12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for fans performance forms, including the following:
 - a. Settings for outdoor-, return-, and exhaust-air dampers.
 - b. Conditions of filters.
 - c. Cooling coil, wet- and dry-bulb conditions.
 - d. Heating coil, dry-bulb conditions.
 - e. Face and bypass damper settings at coils.
 - f. Fan drive settings, including settings and percentage of maximum pitch diameter.
 - g. Variable-frequency controller settings for variable-air-volume systems.
 - h. Settings for pressure controller(s).
 - i. Other system operating conditions that affect performance.
16. Test conditions for pump performance forms, including the following:
 - a. Variable-frequency controller settings for variable-flow hydronic systems.
 - b. Settings for pressure controller(s).
 - c. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Water and steam flow rates.
3. Duct, outlet, and inlet sizes.
4. Pipe and valve sizes and locations.
5. Terminal units.
6. Balancing stations.
7. Position of balancing devices.

E. Air-Handling-Unit Test Reports: For air-handling units, include the following:

1. Unit Data:
 - a. Unit identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and unit size.
 - e. Manufacturer's serial number.
 - f. Unit arrangement and class.
 - g. Discharge arrangement.
 - h. Sheave make, size in inches, and bore.
 - i. Center-to-center dimensions of sheave and amount of adjustments in inches.
 - j. Number, make, and size of belts.
 - k. Number, type, and size of filters.
2. Motor Data:
 - a. Motor make, and frame type and size.
 - b. Horsepower and speed.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 - e. Sheave make, size in inches, and bore.
 - f. Center-to-center dimensions of sheave and amount of adjustments in inches.
3. Test Data (Indicated and Actual Values):
 - a. Total airflow rate in cfm.
 - b. Total system static pressure in inches wg.
 - c. Fan speed.
 - d. Inlet and discharge static pressure in inches wg.
 - e. For each filter bank, filter static-pressure differential in inches wg.
 - f. Preheat-coil static-pressure differential in inches wg.
 - g. Cooling-coil static-pressure differential in inches wg.
 - h. Heating-coil static-pressure differential in inches wg.
 - i. List for each internal component with pressure-drop, static-pressure differential in inches wg.
 - j. Outdoor airflow in cfm.
 - k. Return airflow in cfm.
 - l. Outdoor-air damper position.

m. Return-air damper position.

F. Gas- and Oil-Fired Heat Apparatus Test Reports: In addition to manufacturer's factory startup equipment reports, include the following:

1. Unit Data:

- a. System identification.
- b. Location.
- c. Make and type.
- d. Model number and unit size.
- e. Manufacturer's serial number.
- f. Fuel type in input data.
- g. Output capacity in Btu/h.
- h. Ignition type.
- i. Burner-control types.
- j. Motor horsepower and speed.
- k. Motor volts, phase, and hertz.
- l. Motor full-load amperage and service factor.
- m. Sheave make, size in inches, and bore.
- n. Center-to-center dimensions of sheave and amount of adjustments in inches.

2. Test Data (Indicated and Actual Values):

- a. Total airflow rate in cfm.
- b. Entering-air temperature in deg F.
- c. Leaving-air temperature in deg F.
- d. Air temperature differential in deg F.
- e. Entering-air static pressure in inches wg.
- f. Leaving-air static pressure in inches wg.
- g. Air static-pressure differential in inches wg.
- h. Low-fire fuel input in Btu/h.
- i. High-fire fuel input in Btu/h.
- j. Manifold pressure in psig.
- k. High-temperature-limit setting in deg F.
- l. Operating set point in Btu/h.
- m. Motor voltage at each connection.
- n. Motor amperage for each phase.
- o. Heating value of fuel in Btu/h.

G. Electric-Coil Test Reports: For electric furnaces, duct coils, and electric coils installed in central-station air-handling units, include the following:

1. Unit Data:

- a. System identification.
- b. Location.
- c. Coil identification.
- d. Capacity in Btu/h.
- e. Number of stages.

- f. Connected volts, phase, and hertz.
- g. Rated amperage.
- h. Airflow rate in cfm.
- i. Face area in sq. ft..
- j. Minimum face velocity in fpm.

2. Test Data (Indicated and Actual Values):

- a. Heat output in Btu/h.
- b. Airflow rate in cfm.
- c. Air velocity in fpm.
- d. Entering-air temperature in deg F.
- e. Leaving-air temperature in deg F.
- f. Voltage at each connection.
- g. Amperage for each phase.

H. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

- a. System identification.
- b. Location.
- c. Make and type.
- d. Model number and size.
- e. Manufacturer's serial number.
- f. Arrangement and class.
- g. Sheave make, size in inches, and bore.
- h. Center-to-center dimensions of sheave and amount of adjustments in inches.

2. Motor Data:

- a. Motor make, and frame type and size.
- b. Horsepower and speed.
- c. Volts, phase, and hertz.
- d. Full-load amperage and service factor.
- e. Sheave make, size in inches, and bore.
- f. Center-to-center dimensions of sheave and amount of adjustments in inches.
- g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):

- a. Total airflow rate in cfm.
- b. Total system static pressure in inches wg.
- c. Fan speed.
- d. Discharge static pressure in inches wg.
- e. Suction static pressure in inches wg.

I. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:

- a. System fan and air-handling-unit number.
- b. Location and zone.
- c. Traverse air temperature in deg F.
- d. Duct static pressure in inches wg.
- e. Duct size in inches.
- f. Duct area in sq. ft..
- g. Indicated airflow rate in cfm.
- h. Indicated velocity in fpm.
- i. Actual airflow rate in cfm.
- j. Actual average velocity in fpm.
- k. Barometric pressure in psig.

J. Air-Terminal-Device Reports:

1. Unit Data:

- a. System and air-handling unit identification.
- b. Location and zone.
- c. Apparatus used for test.
- d. Area served.
- e. Make.
- f. Number from system diagram.
- g. Type and model number.
- h. Size.
- i. Effective area in sq. ft..

2. Test Data (Indicated and Actual Values):

- a. Airflow rate in cfm.
- b. Air velocity in fpm.
- c. Preliminary airflow rate as needed in cfm.
- d. Preliminary velocity as needed in fpm.
- e. Final airflow rate in cfm.
- f. Final velocity in fpm.
- g. Space temperature in deg F.

K. Instrument Calibration Reports:

1. Report Data:

- a. Instrument type and make.
- b. Serial number.
- c. Application.
- d. Dates of use.
- e. Dates of calibration.

3.15 VERIFICATION OF TAB REPORT

- A. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of Engineer.
- B. Engineer shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to the lesser of either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
- C. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
- D. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the TAB shall be considered incomplete and shall be rejected.
- E. If recheck measurements find the number of failed measurements noncompliant with requirements indicated, proceed as follows:
 - 1. TAB specialists shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection. All changes shall be tracked to show changes made to previous report.
 - 2. If the second final inspection also fails, Owner may pursue others Contract options to complete TAB work.
- F. Prepare test and inspection reports.

3.16 ADDITIONAL TESTS

- A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
- B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION

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SECTION 23 07 13 - DUCT INSULATION

PART 1 - GENERAL

1.1 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.
- B. Related Sections:
 - 1. Section 23 07 16 "HVAC Equipment Insulation."
 - 2. Section 23 07 19 "HVAC Piping Insulation."
 - 3. Section 23 31 13 "Metal Ducts" for duct liners.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- 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.

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.4 QUALITY ASSURANCE

- A. 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.

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. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C553, Type II and ASTM C1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CertainTeed Corporation.
 - b. Johns Manville; a Berkshire Hathaway company.
 - c. Knauf Insulation.
 - d. Manson Insulation Inc.
 - e. Owens Corning.
- G. 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. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CertainTeed Corporation.
 - b. Johns Manville; a Berkshire Hathaway company.
 - c. Knauf Insulation.
 - d. Manson Insulation Inc.
 - e. Owens Corning.

2.2 FIRE-RATED INSULATION SYSTEMS

- A. Fire-Rated Blanket: High-temperature, flexible, blanket insulation with FSK jacket that is tested and certified to provide a 1-hour fire rating by an NRTL acceptable to authorities having jurisdiction.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. 3M.
 - b. CertainTeed Corporation.
 - c. Johns Manville; a Berkshire Hathaway company.

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. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Eagle Bridges - Marathon Industries.
 - c. Foster Brand; H. B. Fuller Construction Products.
 2. 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. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Eagle Bridges - Marathon Industries.
 - c. Foster Brand; H. B. Fuller Construction Products.
 2. Adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 3. 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. PVC Jacket Adhesive: Compatible with PVC jacket.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Dow Corning Corporation.
 - b. Johns Manville; a Berkshire Hathaway company.
 - c. P.I.C. Plastics, Inc.
 - d. Speedline Corporation.
 2. Adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 3. 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."

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: Mastic coatings 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. Vapor-Retarder Mastic: Water based; suitable for indoor use on below ambient services.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Foster Brand; H. B. Fuller Construction Products.
 - c. Knauf Insulation.
 - d. Vimasco Corporation.
 2. Water-Vapor Permeance: Comply with ASTM C755, Section 7.2.2, Table 2, for insulation type and service conditions.
 3. Service Temperature Range: Minus 20 to plus 180 deg F.
 4. Comply with MIL-PRF-19565C, Type II, for permeance requirements, with supplier listing on DOD QPD - Qualified Products Database.
 5. Color: White.
- C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Eagle Bridges - Marathon Industries.
 - c. Foster Brand; H. B. Fuller Construction Products.
 - d. Knauf Insulation.
 2. Water-Vapor Permeance: ASTM E96, greater than 1.0 perm at manufacturer's recommended dry film thickness.
 3. Service Temperature Range: Minus 20 to plus 180 deg F.
 4. Color: White.

2.5 SEALANTS

- A. FSK and Metal Jacket Flashing Sealants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Eagle Bridges - Marathon Industries.
 - c. Foster Brand; H. B. Fuller Construction Products.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.
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."

B. ASJ Flashing Sealants, and Vinyl and PVC Jacket Flashing Sealants:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. 3M.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.
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."

2.6 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.

2.7 FIELD-APPLIED FABRIC-REINFORCING MESH

- A. 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.
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Brand; H. B. Fuller Construction Products.

2.8 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Johns Manville; a Berkshire Hathaway company.
 - b. P.I.C. Plastics, Inc.
 - c. Proto Corporation.
 - d. Speedline Corporation.
 2. Adhesive: As recommended by jacket material manufacturer.
 3. Color: White.
- D. Aluminum Jacket: Comply with ASTM B209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ITW Insulation Systems; Illinois Tool Works, Inc.
 - b. RPR Products, Inc.
 2. Sheet and roll stock ready for shop or field sizing.
 3. Finish and thickness are indicated in field-applied jacket schedules.

4. Moisture Barrier for Indoor Applications: 1-mil-thick, heat-bonded polyethylene and kraft paper.
 5. 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 stucco-embossed aluminum-foil facing.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Polyguard, Inc.

2.9 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C1136.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division.
 - b. Compac Corporation.
 - c. Ideal Tape Co., Inc., an American Biltrite Company.
 - d. Knauf Insulation.
 - e. Venture Tape.
 2. Width: 3 inches.
 3. Thickness: 11.5 mils.
 4. Adhesion: 90 ounces force/inch in width.
 5. Elongation: 2 percent.
 6. Tensile Strength: 40 lbf/inch in width.
 7. 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division.
 - b. Compac Corporation.
 - c. Ideal Tape Co., Inc., an American Biltrite Company.
 - d. Knauf Insulation.
 - e. Venture Tape.
 2. Width: 3 inches.

3. Thickness: 6.5 mils.
 4. Adhesion: 90 ounces force/inch in width.
 5. Elongation: 2 percent.
 6. Tensile Strength: 40 lbf/inch in width.
 7. 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Compac Corporation.
 - b. Ideal Tape Co., Inc., an American Biltrite Company.
 - c. Venture Tape.
 2. Width: 2 inches.
 3. Thickness: 6 mils.
 4. Adhesion: 64 ounces force/inch in width.
 5. Elongation: 500 percent.
 6. Tensile Strength: 18 lbf/inch in width.
- D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division.
 - b. Compac Corporation.
 - c. Ideal Tape Co., Inc., an American Biltrite Company.
 - d. Knauf Insulation.
 - e. Venture Tape.
 2. Width: 2 inches.
 3. Thickness: 3.7 mils.
 4. Adhesion: 100 ounces force/inch in width.
 5. Elongation: 5 percent.
 6. Tensile Strength: 34 lbf/inch in width.

2.10 SECUREMENTS

- A. Aluminum Bands: 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.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. ITW Insulation Systems; Illinois Tool Works, Inc.
 - b. RPR Products, Inc.

B. Insulation Pins and Hangers:

1. 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. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1) AGM Industries, Inc.
 - 2) Gemco.
 - 3) Hardcast, Inc.
 - 4) Midwest Fasteners, Inc.
 - 5) Nelson Stud Welding.
 - b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - c. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
 - d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
2. 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. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1) Gemco.
 - 2) Midwest Fasteners, Inc.
 - b. Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1-1/2 inches in diameter.
 - c. Spindle: Nylon, 0.106-inch-diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches.
 - d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
3. 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. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1) AGM Industries, Inc.
 - 2) Gemco.
 - 3) Hardcast, Inc.
 - 4) Midwest Fasteners, Inc.
 - b. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - c. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
 - d. Adhesive-backed base with a peel-off protective cover.
4. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick, stainless-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. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1) AGM Industries, Inc.
 - 2) Gemco.
 - 3) Hardcast, Inc.
 - 4) Midwest Fasteners, Inc.
 - 5) Nelson Stud Welding.
 - b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
5. 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.
- a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1) Gemco.
 - 2) Midwest Fasteners, Inc.
- C. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.
- D. Wire: 0.080-inch nickel-copper alloy.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

- a. C & F Wire.

2.11 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.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.2 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.

3.3 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" for firestopping and fire-resistive joint sealers.
- 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."

3.4 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.

3.5 FIELD-APPLIED JACKET INSTALLATION

- A. 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.

- B. 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.
- C. 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.

3.6 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."

3.7 FINISHES

- A. Insulation with ASJ 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. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- C. Do not field paint aluminum or stainless-steel jackets.

3.8 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. 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.

- C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.9 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.

3.10 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

- A. Concealed, Supply-Air Duct and Plenum Insulation: Mineral-fiber blanket, 2 inches Insert dimension thick and) 1.5-lb/cu. ft. nominal density.
- B. Concealed, Return-Air Duct and Plenum Insulation: Mineral-fiber blanket, 1-1/2 inches thick and 1.5-lb/cu. ft. nominal density.
- C. Concealed, Outdoor-Air Duct and Plenum Insulation: Mineral-fiber blanket, 2 inches thick and 1.5-lb/cu. ft. nominal density.
- D. Concealed, Exhaust-Air Duct and Plenum Insulation: Mineral-fiber blanket, 2 inches thick and 1.5-lb/cu. ft. nominal density.

- E. 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.
- F. Exposed, Supply-Air Duct and Plenum Insulation: Mineral-fiber blanket, 2 inches thick and 1.5-lb/cu. ft. nominal density.
- G. Exposed, Return-Air Duct and Plenum Insulation: Mineral-fiber blanket, 2 inches thick and 1.5-lb/cu. ft. nominal density.
- H. Exposed, Outdoor-Air Duct and Plenum Insulation: Mineral-fiber blanket, 2 inches thick and 1.5-lb/cu. ft. nominal density.
- I. Exposed, Exhaust-Air Duct and Plenum Insulation: Mineral-fiber blanket, 2 inches thick and 1.5-lb/cu. ft. nominal density.
- J. 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.

3.11 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, Supply-Air Duct and Plenum Insulation: Mineral-fiber blanket, 2 inches thick and 3-lb/cu. ft. nominal density.
- C. Concealed, Return-Air Duct and Plenum Insulation: Mineral-fiber blanket, 2 inches thick and 3-lb/cu. ft. nominal density.
- D. Concealed, Outdoor-Air Duct and Plenum Insulation: Mineral-fiber blanket, 2 inches thick and 3-lb/cu. ft. nominal density.
- E. Exposed, Supply-Air Duct and Plenum Insulation: Mineral-fiber board, 3 inches thick and 1.5-lb/cu. ft. nominal density.
- F. Exposed, Return-Air Duct and Plenum Insulation: Mineral-fiber board, 3 inches thick and 1.5-lb/cu. ft. nominal density.

3.12 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. None.
 - 2. PVC: 20 mils thick.

3. Aluminum, Stucco Embossed: 0.020 inch thick.

D. Ducts and Plenums, Exposed:

1. None.
2. PVC: 30 mils thick.
3. Aluminum, Stucco Embossed: 0.040 inch thick.

3.13 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. None.
 2. PVC: 30 mils thick.
 3. Aluminum, Stucco Embossed: 0.040 inch thick.
- D. Ducts and Plenums, Exposed, up to 48 Inches in Diameter or with Flat Surfaces up to 72 Inches:
1. Aluminum, Stucco Embossed: 0.040 inch thick.
- E. Ducts and Plenums, Exposed, Larger Than 48 Inches in Diameter or with Flat Surfaces Larger Than 72 Inches:
1. Painted Aluminum, Stucco Embossed with: 0.040 inch thick.

END OF SECTION

SECTION 23 07 16 - HVAC EQUIPMENT INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes insulating the following HVAC equipment that is not factory insulated:
 - 1. Heat exchangers.
 - 2. Chilled-water pumps.
 - 3. Dual-service heating and cooling pumps.
 - 4. Heating, hot-water pumps.
 - 5. Expansion/compression tanks.
 - 6. Air separators.
- B. Related Sections:
 - 1. Section 23 07 13 "Duct Insulation."
 - 2. Section 23 07 19 "HVAC Piping Insulation."

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. 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 removable insulation at equipment connections.
 - 4. Detail application of field-applied jackets.
 - 5. Detail application at linkages of control devices.
 - 6. Detail field application for each equipment type.

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.4 QUALITY ASSURANCE

- A. 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.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- B. 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.
- C. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C795.
- D. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- E. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 1. Block Insulation: ASTM C552, Type I.
 2. Special-Shaped Insulation: ASTM C552, Type III.
 3. Board Insulation: ASTM C552, Type IV.
 4. Factory fabricate shapes according to ASTM C450 and ASTM C585.
- F. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C534, Type I for tubular materials and Type II for sheet materials.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Aeroflex USA.
 - b. Armacell LLC.
 - c. K-Flex USA.
- G. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C553, Type II and ASTM C1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

- a. CertainTeed Corporation; Saint-Gobain North America.
 - b. Johns Manville; a Berkshire Hathaway company.
 - c. Knauf Insulation.
 - d. Manson Insulation Inc.
 - e. Owens Corning.
- H. High-Temperature, Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C553, Type V, without factory-applied jacket.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- a. Johns Manville; a Berkshire Hathaway company.
 - b. Knauf Insulation.
 - c. Rockwool International.
- I. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C612, Type IA or Type IB. Provide insulation with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- a. CertainTeed Corporation; Saint-Gobain North America.
 - b. Johns Manville; a Berkshire Hathaway company.
 - c. Knauf Insulation.
 - d. Manson Insulation Inc.
 - e. Owens Corning.
- J. High-Temperature, Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C612, Type III, without factory-applied jacket.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- a. Johns Manville; a Berkshire Hathaway company.
 - b. Rockwool International.
 - c. Thermafiber, Inc.; an Owens Corning company.
- K. 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.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CertainTeed Corporation; Saint-Gobain North America.
 - b. Johns Manville; a Berkshire Hathaway company.
 - c. Knauf Insulation.
 - d. Manson Insulation Inc.
 - e. Owens Corning.
- L. 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.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Armacell LLC.
 - b. Nomaco.
- M. 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 according to ASTM C450 and ASTM C585.

2.2 INSULATING CEMENTS

- A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C449.
 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Ramco Insulation, Inc.

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.
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Foster Brand; H. B. Fuller Construction Products.

- C. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Aeroflex USA.
 - b. Armacell LLC.
 - c. K-Flex USA.
- D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Foster Brand; H. B. Fuller Construction Products.
 - c. Mon-Eco Industries, Inc.
- E. Polystyrene Adhesive: Solvent- or water-based, synthetic resin adhesive with a service temperature range of minus 20 to plus 140 deg F.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Foster Brand; H. B. Fuller Construction Products.
- F. 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Foster Brand; H. B. Fuller Construction Products.
 - c. Mon-Eco Industries, Inc.
- G. PVC Jacket Adhesive: Compatible with PVC jacket.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Johns Manville; a Berkshire Hathaway company.
 - b. P.I.C. Plastics, Inc.
 - c. Speedline Corporation.

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 and outdoor use on below ambient services.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Foster Brand; H. B. Fuller Construction Products.
 - c. Knauf Insulation.
 - 2. Water-Vapor Permeance: Comply with ASTM C755, Section 7.2.2, Table 2, for insulation type and service conditions.
 - 3. Service Temperature Range: Minus 20 to plus 180 deg F.
 - 4. Comply with MIL-PRF-19565C, Type II, for permeance requirements.
 - 5. Color: White.
- C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.
 - 1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
 - 2. Water-Vapor Permeance: ASTM E96, greater than 1.0 perm at manufacturer's recommended dry film thickness.
 - 3. Service Temperature Range: Minus 20 to plus 180 deg F.
 - 4. Color: White.

2.5 SEALANTS

- A. Joint Sealants:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Foster Brand; H. B. Fuller Construction Products.
 - c. Mon-Eco Industries, Inc.
 - 2. Materials shall be compatible with insulation materials, jackets, and substrates.
 - 3. Permanently flexible, elastomeric sealant.
 - 4. Service Temperature Range: Minus 100 to plus 300 deg F.
 - 5. Color: White or gray.
- B. FSK and Metal Jacket Flashing Sealants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Foster Brand; H. B. Fuller Construction Products.
 - c. Mon-Eco Industries, Inc.
 2. Materials shall be compatible with insulation materials, jackets, and substrates.
 3. Fire- and water-resistant, flexible, elastomeric sealant.
 4. Service Temperature Range: Minus 40 to plus 250 deg F.
 5. Color: Aluminum.
- C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 2. Materials shall be compatible with insulation materials, jackets, and substrates.
 3. Fire- and water-resistant, flexible, elastomeric sealant.
 4. Service Temperature Range: Minus 40 to plus 250 deg F.
 5. Color: White.

2.6 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. PVDC Jacket for Indoor Applications: 4-mil-thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perm when tested according to ASTM E96/E96M and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E84.
 6. PVDC Jacket for Outdoor Applications: 6-mil-thick, white PVDC biaxially oriented barrier film with a permeance at 0.01 perm when tested according to ASTM E96/E96M and with a flame-spread index of 5 and a smoke-developed index of 25 when tested according to ASTM E84.
 7. PVDC-SSL Jacket: PVDC jacket with a self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip.

8. 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.

2.7 FIELD-APPLIED FABRIC-REINFORCING MESH

- A. 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 equipment.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Foster Brand; H. B. Fuller Construction Products.
 - b. Vimasco Corporation.

2.8 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Johns Manville; a Berkshire Hathaway company.
 - b. P.I.C. Plastics, Inc.
 - c. Proto Corporation.
 - d. Speedline Corporation.
 2. Adhesive: As recommended by jacket material manufacturer.
 3. Color: Color-code jackets based on system. Color as selected by Engineer.
 4. Factory-fabricated tank heads and tank side panels.
- D. Aluminum Jacket: Comply with ASTM B209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. RPR Products, Inc.
 - b. Childers Brand; H. B. Fuller Construction Products.
 2. Sheet and roll stock ready for shop or field sizing.
 3. Finish and thickness are indicated in field-applied jacket schedules.

4. Moisture Barrier for Indoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.
 5. Moisture Barrier for Outdoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.
 6. Factory-Fabricated Fitting Covers:
 - a. Same material, finish, and thickness as jacket.
 - b. Preformed two-piece or gore, 45- and 90-degree, short- and long-radius elbows.
 - c. Tee covers.
 - d. Flange and union covers.
 - e. End caps.
 - f. Beveled collars.
 - g. Valve covers.
 - h. Field fabricate fitting covers only if factory-fabricated fitting covers are not available.
- 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 stucco-embossed aluminum-foil facing.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Polyguard Products, Inc.
- F. PVDC Jacket for Indoor Applications: 4-mil-thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perm when tested according to ASTM E96/E96M and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E84.
- G. PVDC Jacket for Outdoor Applications: 6-mil-thick, white PVDC biaxially oriented barrier film with a permeance at 0.01 perm when tested according to ASTM E96/E96M and with a flame-spread index of 5 and a smoke-developed index of 25 when tested according to ASTM E84.
- H. PVDC-SSL Jacket: PVDC jacket with a self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip.

2.9 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C1136.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division.

- b. Ideal Tape Co., Inc., an American Biltrite Company.
 - c. Knauf Insulation.
 - 2. Width: 3 inches.
 - 3. Thickness: 11.5 mils.
 - 4. Adhesion: 90 ounces force/inch in width.
 - 5. Elongation: 2 percent.
 - 6. Tensile Strength: 40 lbf/inch in width.
 - 7. 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division.
 - b. Ideal Tape Co., Inc., an American Biltrite Company.
 - c. Knauf Insulation.
 - 2. Width: 3 inches.
 - 3. Thickness: 6.5 mils.
 - 4. Adhesion: 90 ounces force/inch in width.
 - 5. Elongation: 2 percent.
 - 6. Tensile Strength: 40 lbf/inch in width.
 - 7. 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. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Ideal Tape Co., Inc., an American Biltrite Company.
 - 2. Width: 2 inches.
 - 3. Thickness: 6 mils.
 - 4. Adhesion: 64 ounces force/inch in width.
 - 5. Elongation: 500 percent.
 - 6. Tensile Strength: 18 lbf/inch in width.
- D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division.
 - b. Ideal Tape Co., Inc., an American Biltrite Company.
 - c. Knauf Insulation.

2. Width: 2 inches.
 3. Thickness: 3.7 mils.
 4. Adhesion: 100 ounces force/inch in width.
 5. Elongation: 5 percent.
 6. 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: 4 mils.
 3. Adhesive Thickness: 1.5 mils.
 4. Elongation at Break: 145 percent.
 5. Tensile Strength: 55 lbf/inch 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 lbf/inch in width.

2.10 SECUREMENTS

- A. Aluminum Bands: 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.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. RPR Products, Inc.
- B. Insulation Pins and Hangers:
1. 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.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) AGM Industries, Inc.
 - 2) Gemco.
 - 3) Midwest Fasteners, Inc.

- b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - c. Spindle: Stainless steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
 - d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
- 2. 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.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Gemco.
 - 2) Midwest Fasteners, Inc.
 - b. Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1-1/2 inches in diameter.
 - c. Spindle: Nylon, 0.106-inch-diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches.
 - d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
- 3. 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.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) AGM Industries, Inc.
 - 2) Gemco.
 - 3) Midwest Fasteners, Inc.
 - b. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - c. Spindle: Stainless steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
 - d. Adhesive-backed base with a peel-off protective cover.
- 4. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick, stainless-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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- 1) AGM Industries, Inc.
 - 2) Gemco.
 - 3) Midwest Fasteners, Inc.
 - 4) Nelson Stud Welding.
- b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
5. 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.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. C & F Wire.

2.11 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.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment 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.
 - 4. Cover inserts with jacket material matching adjacent insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- 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.
- 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.
- O. 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. Manholes.
 5. Handholes.
 6. Cleanouts.

3.3 INSTALLATION OF EQUIPMENT, TANK, AND VESSEL INSULATION

- A. Mineral-Fiber, Pipe and Tank Insulation Installation for Tanks and Vessels: Secure insulation with adhesive and anchor pins and speed washers.
 1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of tank and vessel surfaces.
 2. Groove and score insulation materials to fit as closely as possible to equipment, including contours. Bevel insulation edges for cylindrical surfaces for tight joints. Stagger end joints.
 3. Protect exposed corners with secured corner angles.
 4. Install adhesively attached or self-sticking insulation hangers and speed washers on sides of tanks and vessels as follows:
 - a. Do not weld anchor pins to ASME-labeled pressure vessels.
 - b. Select insulation hangers and adhesive that are compatible with service temperature and with substrate.
 - c. On tanks and vessels, maximum anchor-pin spacing is 3 inches from insulation end joints, and 16 inches o.c. in both directions.
 - d. Do not overcompress insulation during installation.

- e. Cut and miter insulation segments to fit curved sides and domed heads of tanks and vessels.
 - f. Impale insulation over anchor pins and attach speed washers.
 - g. 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.
 5. Secure each layer of insulation with stainless-steel or aluminum bands. Select band material compatible with insulation materials.
 6. Where insulation hangers on equipment and vessels are not permitted or practical and where insulation support rings are not provided, install a girdle network for securing insulation. Stretch prestressed aircraft cable around the diameter of vessel and make taut with clamps, turnbuckles, or breather springs. Place one circumferential girdle around equipment approximately 6 inches from each end. Install wire or cable between two circumferential girdles 12 inches o.c. Install a wire ring around each end and around outer periphery of center openings, and stretch prestressed aircraft cable radially from the wire ring to nearest circumferential girdle. Install additional circumferential girdles along the body of equipment or tank at a minimum spacing of 48 inches o.c. Use this network for securing insulation with tie wire or bands.
 7. Stagger joints between insulation layers at least 3 inches.
 8. Install insulation in removable segments on equipment access doors, manholes, handholes, and other elements that require frequent removal for service and inspection.
 9. Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.
 10. For equipment with surface temperatures below ambient, apply mastic to open ends, joints, seams, breaks, and punctures in insulation.
- B. Flexible Elastomeric Thermal Insulation Installation for Tanks and Vessels: Install insulation over entire surface of tanks and vessels.
1. Apply 100 percent coverage of adhesive to surface with manufacturer's recommended adhesive.
 2. Seal longitudinal seams and end joints.
- C. Insulation Installation on Pumps:
1. Fabricate metal boxes lined with insulation. Fit boxes around pumps and coincide box joints with splits in pump casings. Fabricate joints with outward bolted flanges. Bolt flanges on 6-inch centers, starting at corners. Install 3/8-inch-diameter fasteners with wing nuts. Alternatively, secure the box sections together using a latching mechanism.
 2. Fabricate boxes from aluminum, at least 0.050 inch thick.
 3. For below ambient services, install a vapor barrier at seams, joints, and penetrations. Seal between flanges with replaceable gasket material to form a vapor barrier.

3.4 FIELD-APPLIED JACKET INSTALLATION

- A. 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.
- B. 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.
- C. 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.
- D. Where PVDC jackets are indicated, install as follows:
1. 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. 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.
 2. 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.

3.5 FINISHES

- A. Equipment 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.

3.6 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections: Inspect field-insulated equipment, 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 type of equipment defined in the "Equipment Insulation Schedule" Article. For large equipment, remove only a portion adequate to determine compliance.
- C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.7 BREECHING INSULATION SCHEDULE

- A. Round, Exposed Breeching and Connector: High-temperature mineral-fiber board, 3 inches thick and 3-lb/cu. ft. nominal density.
- B. Round, Concealed Breeching and Connector Insulation: High-temperature mineral-fiber blanket, 3 inches thick and 3-lb/cu. ft. nominal density.

3.8 EQUIPMENT INSULATION SCHEDULE

- A. Insulation materials and thicknesses are identified below. If more than one material is listed for a type of equipment, selection from materials listed is Contractor's option.
- B. Insulate indoor and outdoor equipment that is not factory insulated.
- C. Chilled-water pump insulation shall be one of the following:
 - 1. Cellular Glass: 3 inches thick.
 - 2. Mineral-Fiber Board: 2 inches thick and 2-lb/cu. ft. nominal density.
 - 3. Phenolic: 2 inches thick.
- D. Heat-Exchanger (Water-to-Water for Heating Service) Insulation: Mineral-fiber pipe and tank, 2 inches thick.
- E. Dual-service heating and cooling pump insulation shall be one of the following:
 - 1. Cellular Glass: 3 inches thick.

2. Mineral-Fiber Board: 2 inches thick and 2-lb/cu. ft. nominal density.
- F. Heating-Hot-Water Pump Insulation: Mineral-Fiber Board: 2 inches thick and 2-lb/cu. ft. nominal density.
- G. Chilled-water expansion/compression tank insulation shall be one of the following:
1. Cellular Glass: 1-1/2 inches thick.
 2. Flexible Elastomeric: 1 inch thick.
 3. Mineral-Fiber Pipe and Tank: 1 inch thick.
 4. Polyolefin: 1 inch thick.
- H. Dual-service heating and cooling expansion/compression tank insulation shall be one of the following:
1. Cellular Glass: 1-1/2 inches thick.
 2. Flexible Elastomeric: 1 inch thick.
 3. Mineral-Fiber Pipe and Tank: 1 inch thick.
 4. Polyolefin: 1 inch thick.
- I. Heating-Hot-Water Expansion/Compression Tank Insulation: Mineral-Fiber Pipe and Tank: 1 inch thick.
- J. Chilled-water air-separator insulation shall be one of the following:
1. Cellular Glass: 2 inches thick.
 2. Flexible Elastomeric: 1 inch thick.
 3. Mineral-Fiber Pipe and Tank: 1 inch thick.
 4. Polyolefin: 1 inch thick.
- K. Dual-service heating and cooling air-separator insulation shall be one of the following:
1. Cellular Glass: 2 inches thick.
 2. Flexible Elastomeric: 1 inch thick.
 3. Mineral-Fiber Pipe and Tank: 1 inch thick.
 4. Polyolefin: 1 inch thick.
- L. Heating-Hot-Water Air-Separator Insulation: Mineral-Fiber Pipe and Tank: 2 inches thick.

3.9 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. Equipment, Concealed:
1. PVC: 20 mils thick.

2. Aluminum, Stucco Embossed: 0.020 inch thick.
- D. Equipment, Exposed, up to 48 Inches in Diameter or with Flat Surfaces up to 72 Inches:
 1. PVC, Color-Coded by System: 20 mils thick.
 2. Aluminum, Stucco Embossed: 0.020 inch thick.
 - E. Equipment, Exposed, Larger Than 48 Inches in Diameter or with Flat Surfaces Larger Than 72 Inches:
 1. Painted Aluminum, Smooth with 1-1/4-Inch-Deep Corrugations: 0.032 inch thick.

3.10 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. Equipment, Exposed, up to 48 Inches in Diameter or with Flat Surfaces up to 72 Inches:
 1. Painted Aluminum, Stucco Embossed with Z-Shaped Locking Seam: 0.020 inch thick.
- D. Equipment, Exposed, Larger Than 48 Inches in Diameter or with Flat Surfaces Larger Than 72 Inches:
 1. Painted Aluminum, Stucco Embossed with 1-1/4-Inch-Deep Corrugations: 0.040 inch thick.

END OF SECTION

SECTION 23 11 23 - FACILITY NATURAL-GAS PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipes, tubes, and fittings.
2. Piping specialties.
3. Joining materials.
4. Manual gas shutoff valves.
5. Motorized gas valves.
6. Earthquake valves.
7. Pressure regulators.
8. Dielectric fittings.

1.2 ACTION SUBMITTALS

A. Product Data:

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.
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 service-meter assembly and pressure regulator assembly.

1.3 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. Certificates:

1. Welding certificates.
- C. Site Survey: Plans, drawn to scale, on which natural-gas piping is shown and coordinated with other services and utilities.
- D. Field Quality-Control Submittals:
 1. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

- A. Qualifications:
 1. Steel Support Welding: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 2. Pipe Welding: Qualify procedures and operators in accordance with the ASME Boiler and Pressure Vessel Code.

1.6 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 in accordance with requirements indicated:
 1. Notify Construction Manager 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.

1.7 COORDINATION

- A. Coordinate requirements for access panels and doors for valves installed and concealed behind finished surfaces. Comply with requirements in Section 08 31 13 "Access Doors and Frames."
- B. Coordinate requirements for piping identification for natural-gas piping. Comply with requirements in Section 22 05 53 "Identification of Plumbing Piping and Equipment."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Comply with NFPA 54.
- B. 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: 5 psig.
- C. Natural-Gas System Pressure within Buildings:
 - 1. Single Pressure: More than 0.5 psig, but not more than 2 psig.
- D. 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.
- E. Seismic Performance: Natural-gas piping system is to withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7. See Section 22 05 48 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
 - 1. The term "withstand" means "the piping system will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the piping system will be fully operational after the seismic event."
 - 2. Component Importance Factor: 1.5.

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. 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.

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. Seals: Nitrile.
 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. Weatherproof Vent Cap:
1. 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. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
 - 6. Service Mark: Valves NPS 1-1/4 to NPS 2 having 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" permanently marked on valve body.
- D. One-Piece, Bronze Ball Valve with Bronze Trim: MSS SP-110.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
 - b. BrassCraft Manufacturing Co.; a Masco company.
 - c. Perfection Corporation.
 - 2. Body: Bronze, complying with ASTM B584.
 - 3. Ball: Chrome-plated brass.
 - 4. Stem: Bronze; blowout proof.
 - 5. Seats: Reinforced TFE; blowout proof.
 - 6. Packing: Separate packnut with adjustable-stem packing threaded ends.
 - 7. Ends: Threaded, flared, or socket as indicated in "Underground, Manual Gas Shutoff Valve Schedule" and "Aboveground, Manual Gas Shutoff Valve Schedule" articles.
 - 8. CWP Rating: 600 psig.

9. Listing: Valves NPS 1 and smaller are to be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 10. 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. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
 - b. BrassCraft Manufacturing Co.; a Masco company.
 - c. Perfection Corporation.
 2. Body: Bronze, complying with ASTM B584.
 3. Ball: Chrome-plated bronze.
 4. Stem: Bronze; blowout proof.
 5. Seats: Reinforced TFE; blowout proof.
 6. Packing: Threaded-body packnut design with adjustable-stem packing.
 7. Ends: Threaded, flared, or socket as indicated in "Underground, Manual Gas Shutoff Valve Schedule" and "Aboveground, Manual Gas Shutoff Valve Schedule" articles.
 8. CWP Rating: 600 psig.
 9. Listing: Valves NPS 1 and smaller are to be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 10. 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. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
 - b. BrassCraft Manufacturing Co.; a Masco company.
 - c. Perfection Corporation.
 2. Body: Bronze, complying with ASTM B584.
 3. Ball: Chrome-plated bronze.
 4. Stem: Bronze; blowout proof.
 5. Seats: Reinforced TFE.
 6. Packing: Threaded-body packnut design with adjustable-stem packing.
 7. Ends: Threaded, flared, or socket as indicated in "Underground, Manual Gas Shutoff Valve Schedule" and "Aboveground, Manual Gas Shutoff Valve Schedule" articles.
 8. CWP Rating: 600 psig.
 9. Listing: Valves NPS 1 and smaller are to be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- G. Bronze Plug Valves: MSS SP-78.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. A.Y. McDonald Mfg. Co.
 - b. Lee Brass Company.
2. Body: Bronze, complying with ASTM B584.
3. Plug: Bronze.
4. Ends: Threaded, socket, or flanged as indicated in "Underground, Manual Gas Shutoff Valve Schedule" and "Aboveground, Manual Gas Shutoff Valve Schedule" articles.
5. Operator: Square head or lug type with tamperproof feature where indicated.
6. Pressure Class: 125 psig.
7. Listing: Valves NPS 1 and smaller are to 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.

H. Valve Boxes:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Kerotest Manufacturing Corp.
 - b. Perfection Corporation.
 - c. R.W. Lyall; brand of Hubbell Utility Solutions; Hubbell Incorporated.
2. Cast-iron, two-section box.
3. Top section with cover with "GAS" lettering.
4. Bottom section with base to fit over valve and barrel a minimum of 5 inches in diameter.
5. Adjustable cast-iron extensions of length required for depth of bury.
6. 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. Electrically Operated Valves: Comply with UL 429.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Eclipse Innovative Thermal Technologies.
 - b. Magnatrol Valve Corporation.
 - c. Parker Hannifin Corporation.
 - d. WATTS.

2. Pilot operated.
3. Body: Brass or aluminum.
4. Seats and Disc: NBR.
5. Springs and Valve Trim: Stainless steel.
6. 120 V ac, 60 Hz, Class B, continuous-duty molded coil, and replaceable.
7. NEMA ICS 6, Type 4, coil enclosure.
8. Normally closed.
9. Visual position indicator.

2.7 EARTHQUAKE VALVES

- A. Earthquake Valves, Maximum Operating Pressure of 5 psig: Comply with ASCE/SEI 25.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Firefighter Gas Safety Products.
 - b. Pacific Seismic Products, Inc.
 2. Listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 3. Maximum Operating Pressure: 5 psig.
 4. Cast-aluminum body with nickel-plated chrome steel internal parts.
 5. NBR valve washer.
 6. Sight windows for visual indication of valve position.
 7. Threaded end connections complying with ASME B1.20.1.
 8. Wall-mounting bracket with bubble level indicator.

2.8 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. Line Pressure Regulators: Comply with ANSI Z21.80A.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Actaris; a brand of ITT Controls.
 - b. Dormont; a WATTS brand.
 - c. Eclipse Innovative Thermal Technologies.

- d. [Maxitrol Company.](#)
 - 2. Body and Diaphragm Case: Cast iron or die-cast aluminum.
 - 3. Springs: Zinc-plated steel; interchangeable.
 - 4. Diaphragm Plate: Zinc-plated steel.
 - 5. Seat Disc: NBR; resistant to gas impurities, abrasion, and deformation at the valve port.
 - 6. Orifice: Aluminum; interchangeable.
 - 7. Seal Plug: UV-stabilized, mineral-filled nylon.
 - 8. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to regulator.
 - 9. Pressure regulator is to maintain discharge pressure setting downstream and is to not exceed 150 percent of design discharge pressure at shutoff.
 - 10. Overpressure Protection Device: Factory mounted on pressure regulator.
 - 11. Atmospheric Vent: Factory- or field-installed, stainless steel screen in opening if not connected to vent piping.
 - 12. Maximum Inlet Pressure: 2 psig.
- C. Appliance Pressure Regulators: Comply with ANSI Z21.18.
 - 1. [Manufacturers:](#) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. [Dormont; a WATTS brand.](#)
 - b. [Eaton.](#)
 - c. [Harper Wyman Co.](#)
 - d. [Maxitrol Company.](#)
 - 2. Body and Diaphragm Case: Die-cast aluminum.
 - 3. Springs: Zinc-plated steel; interchangeable.
 - 4. Diaphragm Plate: Zinc-plated steel.
 - 5. Seat Disc: NBR.
 - 6. Seal Plug: UV-stabilized, mineral-filled nylon.
 - 7. Factory-Applied Finish: Minimum three-layer polyester and polyurethane paint finish.
 - 8. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.
 - 9. Maximum Inlet Pressure: 2 psig.

2.9 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. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. WATTS.
 - b. Wilkins.
 - c. Zurn Industries, LLC.
2. 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.

2.10 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 and rated pressure 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.
- B. Label and identify gas piping and pressure outside a multitenant building by tenant.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Close equipment shutoff valves before turning off natural gas to premises or piping section.
- B. Inspect natural-gas piping in accordance with NFPA 54 to determine that natural-gas utilization devices are turned off in piping section affected.
- C. Comply with NFPA 54 requirements for preventing accidental ignition.

3.2 INSTALLATION OF OUTDOOR PIPING

- 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 in accordance with 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 gauge upstream and downstream from each service regulator. Pressure gauges are specified in Section 23 05 19 "Meters and Gauges for HVAC Piping."

3.3 INSTALLATION OF INDOOR PIPING

- 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. Do not install piping in concealed locations unless sleeved with the sleeve open at both ends.
- 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. Where installing piping above accessible ceilings, allow sufficient space for ceiling panel removal.
- G. Locate valves for easy access. Do not locate valves within return air plenums.
- 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. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
- Q. Connect branch piping from top or side of horizontal piping.
- R. 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.
- S. Do not use natural-gas piping as grounding electrode.
- T. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.
- U. Install pressure gauge upstream and downstream from each line regulator. Pressure gauges are specified in Section 23 05 19 "Meters and Gauges for HVAC Piping."
- V. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 23 05 17 "Sleeves and Sleeve Seals for HVAC Piping."
- W. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 23 05 17 "Sleeves and Sleeve Seals for HVAC Piping."

3.4 INSTALLATION OF VALVES

- 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.
- F. Do not install valves in return-air plenums.

3.5 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 in accordance with 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 in accordance with AWS's "Brazing Handbook," "Pipe and Tube" Chapter.
- F. 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, and then use wrench. Do not overtighten.

- G. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join in accordance with ASTM D2657.
 - 1. Plain-End Pipe and Fittings: Use butt fusion.
 - 2. Plain-End Pipe and Socket Fittings: Use socket fusion.

3.6 INSTALLATION OF HANGERS AND SUPPORTS

- A. Comply with requirements for seismic-restraint devices specified in Section 23 05 48 "Vibration and Seismic Controls for HVAC."
- B. Comply with requirements in Section 23 05 29 "Hangers and Supports for HVAC Piping and Equipment" for hangers, supports, and anchor devices.
- C. Install hangers for steel piping and copper tubing, with maximum horizontal spacing and minimum rod diameters, to comply with MSS SP-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 SP-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.

3.7 PIPING 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 in accordance with NFPA 70.
- C. Where installing piping adjacent to appliances, allow space for 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.

3.8 LABELING AND IDENTIFICATION

- A. Comply with requirements in Section 23 05 53 "Identification for HVAC Piping and Equipment" 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.

3.9 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. Test, inspect, and purge natural gas in accordance with NFPA 54 and authorities having jurisdiction.
 - 2. Natural-gas piping will be considered defective if it does not pass tests and inspections.
- B. Prepare test and inspection reports.

3.10 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain earthquake valves.

3.11 OUTDOOR PIPING SCHEDULE

- A. Underground natural-gas piping is to be one of the following:
 - 1. Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.
 - 2. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.
- B. Aboveground natural-gas piping is to 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.

3.12 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES LESS THAN 0.5 PSIG

- A. Aboveground, branch piping NPS 1 and smaller is to be the following:
 - 1. Steel pipe with malleable-iron fittings and threaded joints.
- B. Aboveground, distribution piping is to 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.

C. Underground, below building, piping is to 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. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.
4. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground portion of vent pipe and fittings with protective coating for steel piping.

3.13 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES MORE THAN 0.5 PSIG AND LESS THAN OR EQUAL TO 2 PSIG

A. Aboveground, branch piping NPS 1 and smaller is to be the following:

1. Steel pipe with malleable-iron fittings and threaded joints.

B. Aboveground, distribution piping is to 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.

C. Underground, below building, piping is to 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. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat underground pipe and fittings with protective coating for steel piping.
4. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground portion of vent pipe and fittings with protective coating for steel piping.

3.14 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. NPS 2 and Smaller: Bronze plug valves.

3.15 ABOVEGROUND, MANUAL GAS SHUTOFF VALVE SCHEDULE

A. Valves for pipe sizes NPS 2 and smaller at service meter are to be one of the following:

1. One-piece, bronze ball valve with bronze trim.
 2. Two-piece, full-port, bronze ball valves with bronze trim.
 3. Bronze plug valve.
- B. Distribution piping valves for pipe sizes NPS 2 and smaller are to be one of the following:
1. One-piece, bronze ball valve with bronze trim.
 2. Two-piece, full-port, bronze ball valves with bronze trim.
 3. Bronze plug valve.
- C. Valves in branch piping for single appliance are to be one of the following:
1. One-piece, bronze ball valve with bronze trim.
 2. Two-piece, full-port, bronze ball valves with bronze trim.
 3. Bronze plug valve.

END OF SECTION

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SECTION 23 23 00 - REFRIGERANT PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Copper tube and fittings.
 - 2. Steel pipe and fittings.
 - 3. Valves and specialties.
 - 4. Refrigerants.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of valve, refrigerant piping, and refrigerant piping specialty.
- B. Shop Drawings:
 - 1. Show piping size and 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.
 - 2. Show interface and spatial relationships between piping and equipment.
 - 3. Shop Drawing Scale: 1/4 inch equals 1 foot.

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."
- B. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Line Test Pressure for Refrigerant R-134a:
 - 1. Suction Lines for Air-Conditioning Applications: 115 psig.
 - 2. Suction Lines for Heat-Pump Applications: 225 psig.
 - 3. Hot-Gas and Liquid Lines: 225 psig.
- B. Line Test Pressure for Refrigerant R-407C:
 - 1. Suction Lines for Air-Conditioning Applications: 230 psig.
 - 2. Suction Lines for Heat-Pump Applications: 380 psig.
 - 3. Hot-Gas and Liquid Lines: 380 psig.
- C. 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.

2.2 COPPER TUBE AND FITTINGS

- A. Copper Tube: ASTM B 88, Type K or L.
- B. Wrought-Copper Fittings, Solder-Joint: ASME B16.22.
- C. Wrought-Copper Fittings, Brazed-Joint: ASME B16.50.
- D. Wrought-Copper Unions: ASME B16.22.
- E. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.
- F. Brazing Filler Metals: AWS A5.8/A5.8M.
- G. 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. Working Pressure Rating: Factory test at minimum 500 psig.
 - 5. Maximum Operating Temperature: 250 deg F.
- H. Copper-Tube, Pressure-Seal-Joint Fittings for Refrigerant Piping:

1. Standard: UL 207; certified by UL for field installation. Certification as a UL-recognized component alone is unacceptable.
2. Housing: Copper.
3. O-Rings: HNBR or compatible with specific refrigerant.
4. Tools: Manufacturer's approved special tools.
5. Minimum Rated Pressure: 700 psig

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. Refrigerant Locking Caps:

1. Description: Locking-type, tamper-resistant, threaded caps to protect refrigerant charging ports from unauthorized refrigerant access and leakage.
2. Material: Brass, with protective shroud or sleeve.
3. Refrigerant Identification: **[Color-coded, refrigerant specific] [or] [Universal]** design.
4. Special Tool: For installing and unlocking.

F. Solenoid Valves: Comply with AHRI 760 and UL 429; listed and labeled by a National Recognized Testing Laboratory (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 **[24] [115] [208]**-V ac coil.
6. Working Pressure Rating: 400 psig.
7. Maximum Operating Temperature: 240 deg F.

G. 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.

2.4 REFRIGERANTS

- A. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS FOR REFRIGERANT R-410A

- A. Suction Lines: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed or soldered joints.
- B. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications:
1. Copper, Type L, annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.

3.2 INSTALLATION OF PIPING, GENERAL

- 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 Section 23 09 23 "Direct Digital Control (DDC) System for HVAC" and Section 23 09 93.11 "Sequence of Operations for HVAC DDC" 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 08 31 13 "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. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.
- R. Identify refrigerant piping and valves according to Section 23 05 53 "Identification for HVAC Piping and Equipment."
- S. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 23 05 17 "Sleeves and Sleeve Seals for HVAC Piping."
- T. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 23 05 17 "Sleeves and Sleeve Seals for HVAC Piping."
- U. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 23 05 18 "Escutcheons for HVAC Piping."

3.3 PIPE 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. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."
- D. 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.

3.4 INSTALLATION OF HANGERS AND SUPPORTS

- A. Comply with requirements for seismic restraints in Section 23 05 48 "Vibration and Seismic Controls for HVAC."

- B. Comply with Section 23 05 29 "Hangers and Supports for HVAC Piping and Equipment" for hangers, supports, and anchor devices.
- C. 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.
- D. Install hangers for 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.
- E. Support horizontal piping within 12 inches of each fitting.
- F. Support vertical runs of copper tubing to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.5 FIELD QUALITY CONTROL

- A. Perform the following 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 "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.
- B. Prepare test and inspection reports.

3.6 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.

3.7 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. Single-wall round ducts and fittings.
 - 3. Sheet metal materials.
 - 4. Duct liner.
 - 5. Sealants and gaskets.
 - 6. Hangers and supports.
 - 7. 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 31 19 "HVAC Casings" for factory- and field-fabricated casings for mechanical equipment.
 - 4. 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 ventilation equipment, indicating compliance with ASHRAE 62.1, Section 5 - "Systems and Equipment."
 - 2. Product Data: For adhesives, indicating VOC content.

3. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
4. Product Data: For sealants, indicating VOC content.
5. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.
6. 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 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, seismic restraints, and vibration isolation.

D. Delegated-Design Submittal:

1. Sheet metal thicknesses.
2. Joint and seam construction and sealing.
3. Reinforcement details and spacing.
4. Materials, fabrication, assembly, and spacing of hangers and supports.
5. Design Calculations: Calculations, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation for selecting hangers and supports and seismic restraints.

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. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and with performance requirements and design criteria indicated in "Duct Schedule" Article.
- B. Structural Performance: Duct hangers and supports and seismic restraints shall withstand the effects of gravity and seismic loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and ASCE/SEI 7. Seismically brace duct hangers and supports in accordance with SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."
- C. Airstream Surfaces: Surfaces in contact with airstream shall comply with requirements in ASHRAE 62.1.
- D. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment," and Section 7 - "Construction and System Startup."
- E. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."
- F. 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." All longitudinal seams shall be Pittsburgh lock seams unless otherwise specified for specific application.
- 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 SINGLE-WALL ROUND AND FLAT OVAL 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.
 3. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. McGill AirFlow LLC.
 - b. SEMCO, LLC; part of FlaktGroup.
- B. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension).

- C. 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.
- D. 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.
- E. 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."

2.4 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. Carbon-Steel Sheets: Comply with ASTM A1008/A1008M, with oiled, matte finish for exposed ducts.
- D. 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.
- E. 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.

F. Factory- or Shop-Applied Antimicrobial Coating:

1. Apply to the surface of sheet metal that will form the interior surface of the duct. An untreated clear coating shall be applied to the exterior surface.
2. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
3. Coating containing the antimicrobial compound shall have a hardness of 2H, minimum, when tested in accordance with ASTM D3363.
4. 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.
5. Shop-Applied Coating Color: White.
6. Antimicrobial coating on sheet metal is not required for duct containing liner treated with antimicrobial coating.

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.

2.5 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. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. CertainTeed Corporation.
 - b. Johns Manville; a Berkshire Hathaway company.
 - c. Knauf Insulation.
 - d. Owens Corning.
2. 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.
3. 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.
4. 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Armacell LLC.
 - b. K-Flex USA.
 2. 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.
 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."
- 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. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Acoustical Surfaces, Inc.
 - b. Bonded Logic, Inc.
 - c. Ductmate Industries, Inc.
 2. 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.

3. 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.
 4. 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 stainless steel; 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 fpm or 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.

2.6 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: 4 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. <Double click to insert sustainable design text for sealants.>
- 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.
 10. Sealant shall have a VOC content of 420 g/L or less.

11. <Double click to insert sustainable design text for sealants.>
 12. Maximum Static-Pressure Class: 10-inch wg, positive or negative.
 13. Service: Indoor or outdoor.
 14. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
- D. 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. <Double click to insert sustainable design text for sealants.>
- E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.
- F. 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 for 10-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.

2.7 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.

2.8 SEISMIC-RESTRAINT DEVICES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
1. Kinetics Noise Control, Inc.
 2. Mason Industries, Inc.
- B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an agency acceptable to authorities having jurisdiction.
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.
- C. 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.
- D. Restraint Cables: 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.
- E. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.
- F. 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 ducts exposed to view shall be constructed of stainless steel as per "Duct Schedule" Article. All ducts concealed from view shall be stainless steel as per "Duct Schedule" Article.
- D. All joints shall be welded and shall be telescoping, bell, or flange joint as per NFPA 96.
- E. 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.
- F. 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-inch trapped 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 ADDITIONAL INSTALLATION REQUIREMENTS FOR LABORATORY EXHAUST AND FUME HOOD EXHAUST DUCTS

- A. Install ducts in accordance with NFPA 45, "Fire Protection for Laboratories Using Chemicals."
- B. Install exhaust ducts without dips and traps that may hold water. Slope ducts a minimum of 2 percent back to hood or inlet. Where indicated on Drawings, install trapped drain piping.
- C. Connect duct to fan, fume hood, and other equipment indicated on Drawings.

3.6 DUCTWORK EXPOSED TO WEATHER

- A. All external joints are to 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.
 - 2. Ductwork shall be galvanized 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."
 - 3. Where ducts have external insulation, provide weatherproof aluminum jacket. See Section 23 07 13 "Duct Insulation."

3.7 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.

3.8 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.

3.9 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.

3.10 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."

3.11 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, selected by Engineer from sections installed, totaling no less than 25 percent of total installed duct area for each designated pressure class.
 - b. Supply Ducts with a Pressure Class of 4-Inch wg or Higher: Test representative duct sections, selected by Engineer from sections installed, 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, selected by Engineer from sections installed, 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, selected by Engineer from sections installed, 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, selected by Engineer from sections installed,

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.

3.12 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.

3.13 STARTUP

- A. Air Balance: Comply with requirements in Section 23 05 93 "Testing, Adjusting, and Balancing for HVAC."

3.14 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.
 - 2. Underground Ducts: Concrete-encased, stainless steel.
- 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: C.
 - c. SMACNA Leakage Class for Rectangular: 16.
 - d. SMACNA Leakage Class for Round and Flat Oval: 16.
 - 2. Ducts Connected to Constant-Volume Air-Handling Units:
 - a. Pressure Class: Positive 3-inch wg.
 - b. Minimum SMACNA Seal Class: B.
 - c. SMACNA Leakage Class for Rectangular: 8.
 - d. SMACNA Leakage Class for Round and Flat Oval: 8.
 - 3. Ducts Connected to Variable-Air-Volume Air-Handling Units:
 - a. Pressure Class: Positive 4-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 4.
 - d. SMACNA Leakage Class for Round and Flat Oval: 4.
 - 4. Ducts Connected to Equipment Not Listed Above:
 - a. Pressure Class: Positive 2-inch wg.
 - b. Minimum SMACNA Seal Class: C.
 - c. SMACNA Leakage Class for Rectangular: 16.
 - d. SMACNA Leakage Class for Round and Flat Oval: 16.
- C. Return 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: C.
 - c. SMACNA Leakage Class for Rectangular: 16.
 - d. SMACNA Leakage Class for Round and Flat Oval: 16.
 - 2. Ducts Connected to Air-Handling Units:

- a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: B.
 - c. SMACNA Leakage Class for Rectangular: 8.
 - d. SMACNA Leakage Class for Round and Flat Oval: 8.
 - 3. Ducts Connected to Equipment Not Listed above:
 - a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: C.
 - c. SMACNA Leakage Class for Rectangular: 16.
 - d. SMACNA Leakage Class for Round and Flat Oval: 16.
- 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: C if negative pressure, and A if positive pressure.
 - c. SMACNA Leakage Class for Rectangular: 8.
 - d. SMACNA Leakage Class for Round and Flat Oval: 8.
 - 2. Ducts Connected to Equipment Not Listed above:
 - a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: A if negative pressure; A if positive pressure.
 - c. SMACNA Leakage Class for Rectangular: 16.
 - d. SMACNA Leakage Class for Round and Flat Oval: 16.
- E. Intermediate Reinforcement:
- 1. Galvanized-Steel Ducts: Galvanized steel.
 - 2. Stainless-Steel Ducts:
 - a. Exposed to Airstream: Match duct material.
 - b. Not Exposed to Airstream: Match duct material.
 - 3. Aluminum Ducts: Aluminum.
- F. Liner:
- 1. No Duct Liner
- G. 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: Standing seam.

H. 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 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Manual volume dampers.
2. Control dampers.
3. Fire dampers.
4. Smoke dampers.
5. Flange connectors.
6. Turning vanes.
7. Duct-mounted access doors.
8. Duct access panel assemblies.
9. Flexible connectors.
10. Duct accessory hardware.

B. Related Requirements:

1. Section 23 33 46 "Flexible Ducts" for insulated and non-insulated flexible ducts.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For duct silencers, include pressure drop, dynamic insertion loss, and self-generated noise data. Include breakout noise calculations for high-transmission-loss casings.

B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details, and attachments to other work.

1. Detail duct accessories' fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:
 - a. Special fittings.
 - b. Manual volume damper installations.
 - c. Control-damper installations.
 - d. Fire-damper, smoke-damper, combination fire- and smoke-damper, ceiling, and corridor-damper installations, including sleeves; and duct-mounted access doors and remote damper operators.
 - e. Duct security bars.
 - f. Include diagrams for power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

- A. Source quality-control reports.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Comply with NFPA 90A and NFPA 90B.
- B. 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.

2.2 MANUAL VOLUME DAMPERS

- A. Standard, Steel, Manual Volume Dampers:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Greenheck Fan Corporation.
 - b. McGill AirFlow LLC.
 - c. Ruskin; Air Distribution Technologies, Inc.; Johnson Controls, Inc.
 - d. United Enertech Corp.
 - 2. Performance:
 - a. Leakage Rating Class III: Leakage not exceeding 40 cfm/sq. ft. against 1-inch wg differential static pressure.
 - 3. Construction:
 - a. Linkage out of airstream.
 - b. Suitable for horizontal or vertical airflow applications.
 - 4. Frames:
 - a. Hat-shaped, 16-gauge-thick, galvanized sheet steel.
 - b. Mitered and welded corners.
 - c. Flanges for attaching to walls and flangeless frames for installing in ducts.

5. Blades:
 - a. Multiple or single blade.
 - b. Parallel- or opposed-blade design.
 - c. Stiffen damper blades for stability.
 - d. Galvanized steel; 16 gauge thick.
6. Blade Axles: Stainless steel.
7. Bearings:
 - a. Molded synthetic.
 - b. Dampers mounted with vertical blades to have thrust bearing at each end of every blade.
8. Tie Bars and Brackets: Galvanized steel.
9. Locking device to hold damper blades in a fixed position without vibration.

B. Jackshaft:

1. Size: 0.5-inch diameter.
2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.

C. Damper Hardware:

1. Zinc-plated, die-cast core with dial and handle, made of 3/32-inch-thick zinc-plated steel, and a 3/4-inch hexagon locking nut.
2. Include center hole to suit damper operating-rod size.
3. Include elevated platform for insulated duct mounting.

2.3 CONTROL DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Greenheck Fan Corporation.
2. Ruskin; Air Distribution Technologies, Inc.; Johnson Controls, Inc.
3. Tamco, Inc.

B. General Requirements:

1. Unless otherwise indicated, use parallel-blade configuration for two-position control, equipment isolation service, and when mixing two airstreams. For other applications, use opposed-blade configuration.
2. Factory or field assemble multiple damper sections to provide a single damper assembly of size required by the application.

C. Performance:

1. AMCA Certification: Test and rate in accordance with AMCA 511.
2. Leakage:
 - a. Class IA: Leakage shall not exceed 3 cfm/sq. ft. against 1-inch wg differential static pressure.
 - b. Class I: Leakage shall not exceed 4 cfm/sq. ft. against 1-inch wg differential static pressure.
 - c. Class II: Leakage shall not exceed 10 cfm/sq. ft. against 1-inch wg differential static pressure.
 - d. Class III: Leakage shall not exceed 40 cfm/sq. ft. against 1-inch wg differential static pressure.
3. Pressure Drop: 0.05 inch wg at 1500 fpm across a 24-by-24-inch damper when tested in accordance with AMCA 500-D, Figure 5.3.
4. Velocity: Up to 3000 fpm.
5. Temperature: Minus 25 to plus 180 deg F.
6. Pressure Rating: Damper close-off pressure equal to fan shutoff pressure with a maximum blade deflection of 1/200 of blade length.

D. Construction:

1. Linkage out of airstream.
2. Suitable for horizontal or vertical airflow applications.
3. Frames:
 - a. Hat, U, or angle shaped.
 - b. 0.08-inch-thick extruded aluminum.
 - c. Mitered and welded corners.
 - d. Flanges for attaching to walls and flangeless frames for installing in ducts.
4. Blades:
 - a. Multiple blade with maximum blade width of 6 inches.
 - b. Parallel-blade design.
 - c. Aluminum.
 - d. 16-gauge-thick single skin or 14-gauge-thick air foil dual skin.
5. Blade Edging Seals:
 - a. Replaceable Closed-cell neoprene.
 - b. Inflatable seal blade edging, or replaceable rubber seals.
6. Blade Jamb Seal: Flexible stainless steel, compression type.
7. Blade Axles: 1/2-inch diameter; stainless steel.
8. Blade-Linkage Hardware: Zinc-plated steel and brass; ends sealed against blade bearings. Linkage mounted out of air stream.
9. Bearings:

- a. Oil-impregnated stainless steel sleeve.
 - b. Dampers mounted with vertical blades to have thrust bearings at each end of every blade.
- E. Damper Actuator - Electric:
 - 1. Electric - 120 V ac.
 - 2. UL 873, plenum rated.
 - 3. Fully modulating.
 - a. Sufficient motor torque and spring torque to drive damper fully open and fully closed with adequate force to achieve required damper seal.
 - b. Minimum 90-degree drive rotation.
 - 4. Clockwise or counterclockwise drive rotation as required for application.
 - 5. Environmental Operating Range:
 - a. Temperature: Minus 40 to plus 130 deg F.
 - b. Humidity: 5 to 95 percent relative humidity noncondensing.
 - 6. Environmental enclosure: NEMA 2.
 - 7. Actuator to be factory mounted and provided with a single-point wiring connection.
- F. Damper Actuator - Pneumatic:
 - 1. Operated by 0 to 20 psig pneumatic signal.
 - 2. Fully modulating with positioner and fail-safe spring return.
 - a. Sufficient power and spring force to drive damper fully open and fully closed with adequate force to achieve required damper seal.
 - b. Maximum 15-second full-stroke closure.
 - 3. Actuator to be factory mounted.
- G. Controllers, Electrical Devices, and Wiring:
 - 1. Comply with requirements for electrical devices and connections specified in Section 23 09 23 "Direct Digital Control (DDC) System for HVAC."
 - 2. Electrical Connection: 115 V, single phase, 60 Hz.

2.4 FIRE DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Greenheck Fan Corporation.
 - 2. Ruskin; Air Distribution Technologies, Inc.; Johnson Controls, Inc.
 - 3. United Enertech Corp.

- B. Type: Static and dynamic; rated and labeled in accordance with UL 555 by an NRTL.
- C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 2000 fpm velocity.
- D. Fire Rating: 1-1/2 hours.
- E. Frame: Curtain type with blades outside airstream; fabricated with roll-formed galvanized steel; with mitered and interlocking corners; gauge in accordance with UL listing.
- F. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel; gauge in accordance with UL listing.
- G. Mounting Orientation: Vertical or horizontal as indicated.
- H. Blades: Roll-formed galvanized sheet steel,. Material gauge is to be in accordance with UL listing.
- I. Horizontal Dampers: Include blade lock and stainless steel closure spring.
- J. Heat-Responsive Device:
 - 1. Replaceable, 165 deg F rated, fusible links.

2.5 SMOKE DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Greenheck Fan Corporation.
 - 2. Ruskin; Air Distribution Technologies, Inc.; Johnson Controls, Inc.
 - 3. United Enertech Corp.
- B. General Requirements:
 - 1. Label to indicate conformance to UL 555 and UL 555S by an NRTL.
 - 2. Label to indicate conformance to NFPA 80 and NFPA 90A by an NRTL.
 - 3. Unless otherwise indicated, use parallel-blade configuration.
 - 4. Factory or field assemble multiple damper sections to provide a single damper assembly of size required by the application.
 - 5. Factory install damper actuator by damper manufacturer as integral part of damper assembly. Coordinate actuator location, mounting, and electrical requirements with damper manufacturer.
- C. Performance:
 - 1. AMCA Certification: Test and rate in accordance with AMCA Publication 511.
 - 2. Leakage:

- a. Class IA: Leakage shall not exceed 3 cfm/sq. ft. against 1-inch wg differential static pressure.
 - b. Class I: Leakage shall not exceed 4 cfm/sq. ft. against 1-inch wg differential static pressure.
 - c. Class II: Leakage shall not exceed 10 cfm/sq. ft. against 1-inch wg differential static pressure.
3. Pressure Drop: 0.05 inch wg at 1500 fpm across a 24-by-24-inch damper when tested in accordance with AMCA 500-D, Figure 5.3.
4. Velocity: Up to 3000 fpm.
5. Temperature: Minus 25 to plus 180 deg F.
6. Pressure Rating: Damper close-off pressure equal to fan shutoff pressure with a maximum blade deflection of 1/200 of blade length.

D. Construction:

1. Suitable for horizontal or vertical airflow applications.
2. Linkage out of airstream.
3. Frame:
 - a. Hat shaped.
 - b. Galvanized sheet steel, with interlocking, gusseted or mechanically attached corners and mounting flange.
 - c. Gauge in accordance with UL listing.
4. Blades:
 - a. Roll-formed, horizontal, airfoil, galvanized.
 - b. Maximum width and gauge in accordance with UL listing.
5. Blade Edging Seals:
 - a. Silicone rubber.
6. Blade Jamb Seal: Flexible stainless steel, compression type.
7. Blade Axles: 1/2-inch diameter; stainless steel; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings. Linkage is to be mounted out of airstream.
8. Bearings:
 - a. Oil-impregnated bronze.

E. Mounting Sleeve: Factory-installed, galvanized sheet steel; length to suit wall or floor application; gauge in accordance with UL listing.

F. Damper Actuator - Electric:

1. Electric - 120 V ac.
2. UL 873, plenum rated.

3. Designed to operate in smoke-control systems complying with UL 555S requirements.
 4. Two position with fail-safe spring return.
 - a. Sufficient motor torque and spring torque to drive damper fully open and fully closed with adequate force to achieve required damper seal.
 - b. Maximum 15-second full-stroke closure.
 - c. Minimum 90-degree drive rotation.
 5. Clockwise or counterclockwise drive rotation as required for application.
 6. Environmental Operating Range:
 - a. Temperature: Minus 40 to plus 130 deg F.
 - b. Humidity: 5 to 95 percent relative humidity noncondensing.
 7. Environmental Enclosure: NEMA 2.
 8. Actuator to be factory mounted and provided with single-point wiring connection.
- G. Damper Actuator - Pneumatic:
1. Operated by 0 to 20 psig pneumatic signal.
 2. Designed to operate in smoke-control systems complying with UL 555S requirements.
 3. Two position with fail-safe spring return.
 - a. Sufficient power and spring force to drive damper fully open and fully closed with adequate force to achieve required damper seal.
 - b. Maximum 15-second full-stroke closure.
 4. Actuator to be factory mounted.
- H. Controllers, Electrical Devices, and Wiring:
1. Comply with requirements for electrical devices and connections specified in Section 23 09 23 "Direct Digital Control (DDC) System for HVAC."
 2. Electrical Connection: 115 V, single phase, 60 Hz.
- I. Accessories:
1. Momentary test switch, ceiling mounted.
 2. Smoke Detector: Integral, factory wired for single-point connection.

2.6 FLANGE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. CL WARD & Family Inc.
 2. Ductmate Industries, Inc; a DMI company.
 3. DynAir; a Carlisle Company.

4. [Elgen Manufacturing.](#)
 5. [Ward Industries; a brand of Hart & Cooley, LLC.](#)
- B. Description: Add-on or roll-formed, factory fabricated, slide-on transverse flange connectors, gaskets, and components.
- C. Material: Galvanized steel.
- D. Gauge and Shape: Match connecting ductwork.

2.7 TURNING VANES

- A. [Manufacturers:](#) Subject to compliance with requirements, provide products by one of the following:
1. [Aero-Dyne Sound Control Co.](#)
 2. [CL WARD & Family Inc.](#)
 3. [Ductmate Industries, Inc; a DMI company.](#)
 4. [Duro Dyne Inc.](#)
 5. [DynAir; a Carlisle Company.](#)
 6. [Elgen Manufacturing.](#)
 7. [Ward Industries; a brand of Hart & Cooley, LLC.](#)
- B. Manufactured Turning Vanes for Metal Ducts: Fabricate curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.
- C. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
- D. General Requirements: Comply 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."
- E. Vane Construction:
1. Single wall for ducts up to 48 inches wide and double wall for larger dimensions.

2.8 DUCT-MOUNTED ACCESS DOORS

- A. [Manufacturers:](#) Subject to compliance with requirements, provide products by one of the following:
1. [CL WARD & Family Inc.](#)
 2. [Ductmate Industries, Inc; a DMI company.](#)

3. [McGill AirFlow LLC.](#)
 4. [Ruskin; Air Distribution Technologies, Inc.; Johnson Controls, Inc.](#)
 5. [United Enertech Corp.](#)
- B. Duct-Mounted Access Doors: Fabricate access panels in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figure 7-2 (7-2M), "Duct Access Doors and Panels," and Figure 7-3, "Access Doors - Round Duct."
1. Door:
 - a. Double wall, rectangular.
 - b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
 - c. 24-gauge-thick galvanized steel or 0.032-inch thick aluminum or 24-gauge-thick stainless steel door panel.
 - d. Vision panel.
 - e. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
 - f. Fabricate doors airtight and suitable for duct pressure class.
 2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
 - a. 24-gauge-thick galvanized steel or 0.032-inch-thick aluminum frame.
 3. Number of Hinges and Locks:
 - a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
 - b. Access Doors up to 18 Inches Square: Continuous and two sash locks.
 - c. Access Doors up to 24 by 48 Inches: Continuous and two compression latches.
 - d. Access Doors Larger Than 24 by 48 Inches: Continuous and two compression latches with outside and inside handles.

2.9 FLEXIBLE CONNECTORS

- A. [Manufacturers:](#) Subject to compliance with requirements, provide products by one of the following:
1. [CL WARD & Family Inc.](#)
 2. [Ductmate Industries, Inc; a DMI company.](#)
 3. [Duro Dyne Inc.](#)
 4. [DynAir; a Carlisle Company.](#)
 5. [Elgen Manufacturing.](#)
 6. [Ventfabrics, Inc.](#)
 7. [Ward Industries; a brand of Hart & Cooley, LLC.](#)
- B. Fire-Performance Characteristics: Adhesives, sealants, fabric materials, and accessory materials shall have flame-spread index not exceeding 25 and smoke-developed index not exceeding 50 when tested in accordance with ASTM E84.

- C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
- D. Materials: Flame-retardant or noncombustible fabrics.
- E. Coatings and Adhesives: Comply with UL 181, Class 1.
- F. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to two strips of 2-3/4-inch-wide, 0.028-inch-thick, galvanized sheet steel or 0.032-inch-thick aluminum sheets. Provide metal compatible with connected ducts.
- G. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
 - 1. Minimum Weight: 26 oz./sq. yd..
 - 2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
 - 3. Service Temperature: Minus 40 to plus 200 deg F.
- H. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.
 - 1. Minimum Weight: 24 oz./sq. yd..
 - 2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
 - 3. Service Temperature: Minus 50 to plus 250 deg F.

2.10 DUCT ACCESSORY HARDWARE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. CL WARD & Family Inc.
 - 2. Ductmate Industries, Inc; a DMI company.
 - 3. Duro Dyne Inc.
 - 4. DynAir; a Carlisle Company.
 - 5. Elgen Manufacturing.
 - 6. Hardcast; Carlisle Construction Materials.
 - 7. United Enertech Corp.
 - 8. Ventfabrics, Inc.
 - 9. Ward Industries; a brand of Hart & Cooley, LLC.
- B. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.
- C. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

2.11 MATERIALS

- A. Galvanized Sheet Steel: Comply with ASTM A653/A653M.
 - 1. Galvanized Coating Designation: G60.
 - 2. Exposed-Surface Finish: Mill phosphatized.
- B. Stainless Steel Sheets: Comply with ASTM A480/A480M, Type 304, and having a No. 2 finish for concealed ducts and No. 3 finish for exposed ducts.
- C. Aluminum Sheets: Comply with ASTM B209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, one-side bright finish for exposed ducts.
- D. Extruded Aluminum: Comply with ASTM B221, Alloy 6063, Temper T6.
- E. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless steel ducts.
- F. 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.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install duct accessories in accordance with applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116 for fibrous-glass ducts.
- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless steel accessories in stainless steel ducts, and aluminum accessories in aluminum ducts.
- C. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.
- D. Where multiple damper sections are necessary to achieve required dimensions, provide reinforcement to fully support damper assembly when fully closed at full system design static pressure.
- E. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
 - 1. Install steel volume dampers in steel ducts.
 - 2. Install aluminum volume dampers in aluminum ducts.

- F. Set dampers to fully open position before testing, adjusting, and balancing.
- G. Install test holes at fan inlets and outlets and elsewhere as indicated and as needed for testing and balancing.
- H. Install fire and smoke dampers in accordance with UL listing.
- I. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
 - 1. On both sides of duct coils.
 - 2. Upstream and downstream from duct filters.
 - 3. At outdoor-air intakes and mixed-air plenums.
 - 4. At drain pans and seals.
 - 5. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
 - 6. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
 - 7. For grease ducts, install at locations and spacing as required by NFPA 96.
 - 8. Control devices requiring inspection.
 - 9. Elsewhere as indicated.
- J. Install access doors with swing against duct static pressure.
- K. Access Door Sizes:
 - 1. One-Hand or Inspection Access: 8 by 5 inches.
 - 2. Two-Hand Access: 12 by 6 inches.
 - 3. Head and Hand Access: 18 by 10 inches.
 - 4. Head and Shoulders Access: 21 by 14 inches.
 - 5. Body Access: 25 by 14 inches.
 - 6. Body plus Ladder Access: 25 by 17 inches.
- L. Label access doors according to Section 23 05 53 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.
- M. Install flexible connectors to connect ducts to equipment.
- N. For fans developing static pressures of 5 inches wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.
- O. Install duct test holes where required for testing and balancing purposes.

3.2 FIELD QUALITY CONTROL

- A. Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors, and verify that size and location of access doors are adequate to perform required operation.
3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation, and verify that vanes do not move or rattle.
5. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION

SECTION 23 33 46 - FLEXIBLE DUCTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Non-insulated flexible ducts.
 - 2. Insulated flexible ducts.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
 - 1. Product data showing compliance with ASHRAE 62.1.
 - 2. Laboratory Test Reports: For insulation, indicating compliance with requirements for low-emitting materials.
- C. Shop Drawings: For flexible ducts.
 - 1. Include plans showing locations and mounting and attachment details.

1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, and coordinated with each other, using input from installers of the items involved.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. 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.
- C. Comply with the Air Diffusion Council's "ADC Flexible Air Duct Test Code FD 72-R1."

- D. Comply with ASTM E96/E96M, "Test Methods for Water Vapor Transmission of Materials."

2.2 NON-INSULATED FLEXIBLE DUCTS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
1. Flexmaster U.S.A., Inc.
 2. JP Lamborn Co.
 3. McGill AirFlow LLC.
 4. Thermaflex; a Flex-Tek Group company.
 5. Ward Industries; a brand of Hart & Cooley, Inc.
- B. Non-Insulated, Flexible Duct: UL 181, Class 1, two-ply vinyl film supported by helically wound, spring-steel wire.
1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
 2. Maximum Air Velocity: 4000 fpm.
 3. Temperature Range: Minus 10 to plus 160 deg F.
- C. Non-Insulated, Flexible Duct: UL 181, Class 1, multiple layers of aluminum laminate supported by helically wound, spring-steel wire.
1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
 2. Maximum Air Velocity: 4000 fpm.
 3. Temperature Range: Minus 20 to plus 210 deg F.

2.3 INSULATED FLEXIBLE DUCTS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
1. Flexmaster U.S.A., Inc.
 2. JP Lamborn Co.
 3. McGill AirFlow LLC.
 4. Thermaflex; a Flex-Tek Group company.
 5. Ward Industries; a brand of Hart & Cooley, Inc.
- B. Insulated, Flexible Duct: UL 181, Class 1, two-ply vinyl film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor-barrier film.
1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
 2. Maximum Air Velocity: 4000 fpm.
 3. Temperature Range: Minus 10 to plus 160 deg F.
 4. Insulation R-Value: Comply with ASHRAE/IES 90.1.

- C. Insulated, Flexible Duct: UL 181, Class 1, multiple layers of aluminum laminate supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor-barrier film.
 - 1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
 - 2. Maximum Air Velocity: 4000 fpm.
 - 3. Temperature Range: Minus 20 to plus 210 deg F.
 - 4. Insulation R-Value: Comply with ASHRAE/IES 90.1.

2.4 FLEXIBLE DUCT CONNECTORS

- A. Clamps: Nylon strap in sizes 3 through 18 inches, to suit duct size.
- B. Non-Clamp Connectors: Liquid adhesive plus tape.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install flexible ducts according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
- B. Install in indoor applications only. Flexible ductwork should not be exposed to UV lighting.
- C. Connect flexible ducts to metal ducts with draw bands.
- D. Install duct test holes where required for testing and balancing purposes.
- E. Installation:
 - 1. Install ducts fully extended.
 - 2. Do not bend ducts across sharp corners.
 - 3. Bends of flexible ducting shall not exceed a minimum of one duct diameter.
 - 4. Avoid contact with metal fixtures, water lines, pipes, or conduits.
 - 5. Install flexible ducts in a direct line, without sags, twists, or turns.
- F. Supporting Flexible Ducts:
 - 1. Suspend flexible ducts with bands 1-1/2 inches wide or wider and spaced a maximum of 48 inches apart. Maximum centerline sag between supports shall not exceed 1/2 inch per 12 inches.
 - 2. Install extra supports at bends placed approximately one duct diameter from center line of the bend.

3. Ducts may rest on ceiling joists or truss supports. Spacing between supports shall not exceed the maximum spacing per manufacturer's written installation instructions.
4. Vertically installed ducts shall be stabilized by support straps at a maximum of 72 inches o.c.

END OF SECTION

SECTION 23 34 13 - AXIAL HVAC FANS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Tubeaxial fans.
2. Vaneaxial fans.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Include plans, elevations, sections, and attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.
4. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
5. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, and base weights.

1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Show fan room layout and relationships between components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate and certify field measurements.
- B. Seismic Qualification Data: Certificates, for fans, accessories, and components, from manufacturer.
- C. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

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. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of unit components.
- C. ASHRAE Compliance:
 - 1. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
- D. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."
- E. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design vibration isolation and seismic restraints, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- F. Seismic Performance: Axial HVAC fans shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
 - 2. Component Importance Factor: 1.5.

2.2 TUBEAXIAL FANS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Greenheck Fan Corporation.
 - 2. Twin City Fans.
 - 3. Cook
- B. Description: Fan wheel and housing, factory-mounted motor with belt or direct drive, an inlet cone section, and accessories.
- C. Housings: Steel with flanged inlet and outlet connections.
- D. Wheel Assemblies: Cast or extruded aluminum with airfoil-shaped blades mounted on cast-iron wheel plate keyed to shaft with solid-steel key.

- E. Wheel Assemblies: Fiberglass-reinforced plastic cured under pressure with airfoil-shaped blades keyed to stainless-steel shaft.
- F. Wheel Assemblies: Cast aluminum; machined and fitted to shaft.
- G. Belt Drives:
 - 1. Factory mounted, with adjustable alignment and belt tensioning.
 - 2. Service Factor Based on Fan Motor Size: 1.5.
 - 3. Fan Shaft: Turned, ground, and polished steel designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.
 - 4. Fan Pulleys: Cast iron with split, tapered bushing; dynamically balanced at factory.
 - 5. Motor Pulleys: Adjustable pitch for use with motors through 5 hp; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
 - 6. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.
 - 7. Belt Guards: Fabricate of prime-coated steel to comply with OSHA and SMACNA requirements for motors with exposed drive belt. Include provisions for adjustment of belt tension, lubrication, and use of tachometer with guard in place.
 - 8. Motor Base: Adjustable rail mount motor base with adjustment screw to set belt tension.
 - 9. Shaft Bearings: Radial, self-aligning bearings.
 - a. Ball-Bearing Rating Life: ABMA 9, L10 of 50,000 hours.
 - b. Roller-Bearing Rating Life: ABMA 11, L10 of 50,000 hours.
 - c. Extend lubrication lines to outside of casing and terminate with grease fittings.
- H. Accessories:
 - 1. Companion Flanges: Rolled flanges of same material as housing.
 - 2. Inspection Door: Bolted door allowing limited access to internal parts of fan, of same material as housing.
 - 3. Propeller Access Section Door: Short duct section bolted to fan inlet and outlet allowing access to internal parts of fan for inspection and cleaning, of same material as housing.
 - 4. Swingout Construction: Assembly allowing entire fan section to swing out from duct for cleaning and servicing, of same material as housing.
 - 5. Mounting Clips: Horizontal ceiling clips welded to fan housing, of same material as housing.
 - 6. Horizontal Support: Pair of supports bolted to fan housing, of same material as housing.
 - 7. Vertical Support: Short duct section with welded brackets bolted to fan housing, of same material as housing.
 - 8. Inlet Screen: On unducted fan inlet - wire-mesh screen, of same material as housing.
 - 9. Outlet Screen: On unducted fan outlet - wire-mesh screen, of same material as housing.

10. Backdraft Dampers: Butterfly style, for bolting to fan discharge or outlet cone, of same material as housing.
11. Shaft Seal: Elastomeric seal and PTFE wear plate, suitable for up to 300 deg F.
12. Motor Cover: Cover with side vents to dissipate motor heat, of same material as housing.
13. Inlet Vanes: Adjustable; with peripheral control linkage operated from outside of airstream, bronze sleeve bearings on each end of vane support, and provision for manual or automatic operation, of same material as housing.
14. Inlet Bell: Curved inlet for when fan is not attached to duct, of same material as housing.
15. Inlet Cone: Round-to-round transition, of same material as housing.
16. Outlet Cone: Round-to-round transition, of same material as housing.
17. Stack Cap: Vertical discharge assembly with backdraft dampers, of same material as housing.
18. Direct-Driven Units: Encase motor in housing outside of airstream. Extend lubrication lines to outside of casing and terminate with grease fittings.
19. Factory-wired motor disconnect switch located on outside of fan housing.

I. Factory Finishes:

1. Sheet Metal Parts: Prime coat before final assembly.
2. Exterior Surfaces: Baked-enamel finish coat after assembly.
3. Coatings: Powder-baked enamel;
 - a. Apply to finished housings.
 - b. Apply to fan wheels.

2.3 VANEAXIAL FANS

- A. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
1. Greenheck Fan Corporation.
 2. Twin City Fans.
 3. Cook
- B. Description: Fan wheel and housing, straightening vane section, factory-mounted motor with belt or direct drive, an inlet cone section, and accessories.
- C. Housings: Steel.
1. Inlet and Outlet Connections: Flanges.
 2. Guide Vane Section: Integral guide vanes downstream from fan wheel designed to straighten airflow.
- D. Wheel Assemblies: Cast aluminum with airfoil-shaped blades mounted on cast-iron wheel plate keyed to shaft with solid-steel key.
- E. Wheel Assemblies: Fiberglass-reinforced plastic cured under pressure with airfoil-shaped blades keyed to stainless-steel shaft.

- F. Wheel Assemblies: Cast-aluminum hub assembly, machined and fitted with threaded bearing wells to receive blade-bearing assemblies with replaceable, cast-aluminum blades; factory mounted and balanced.
- G. Belt Drives: Factory mounted, with final alignment and belt adjustment made after installation.
 - 1. Service Factor Based on Fan Motor Size: 1.5.
 - 2. Fan Shaft: Turned, ground, and polished steel designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.
 - 3. Fan Pulleys: Cast iron with split, tapered bushing; dynamically balanced at factory.
 - 4. Motor Pulleys: Adjustable pitch for use with motors through 5 hp; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
 - 5. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.
 - 6. Belt Guards: Fabricate of steel for motors mounted on outside of fan cabinet.
 - 7. Motor Base: Adjustable rail mount motor base with adjustment screw to set belt tension.
 - 8. Shaft Bearings: Radial, self-aligning bearings.
 - a. Ball-Bearing Rating Life: ABMA 9, L10 of 100,000 hours.
 - b. Roller-Bearing Rating Life: ABMA 11, L10 of 100,000 hours.
 - c. Extend lubrication lines to outside of casing and terminate with grease fittings.
- H. Accessories:
 - 1. Companion Flanges: Rolled flanges of same material as housing.
 - 2. Inspection Door: Bolted door allowing limited access to internal parts of fan, of same material as housing.
 - 3. Propeller Access Section Door: Short duct section bolted to fan inlet and outlet allowing access to internal parts of fan for inspection and cleaning, of same material as housing.
 - 4. Swingout Construction: Assembly allowing entire fan section to swing out from duct for cleaning and servicing, of same material as housing.
 - 5. Mounting Clips: Horizontal ceiling clips welded to fan housing, of same material as housing.
 - 6. Horizontal Support: Pair of supports bolted to fan housing, of same material as housing.
 - 7. Vertical Support: Short duct section with welded brackets bolted to fan housing, of same material as housing.
 - 8. Inlet Screen: On unducted fan inlet - wire-mesh screen, of same material as housing.
 - 9. Outlet Screen: On unducted fan outlet - wire-mesh screen, of same material as housing.
 - 10. Backdraft Dampers: Butterfly style, for mounting with flexible connection to fan discharge or direct mounted to discharge diffuser section, of same material as housing.

11. Stall Alarm Probe: Sensing probe capable of detecting fan operation in stall and signaling control devices. Control devices and sequence of operation are specified in Section 23 09 23.23 "Pressure Instruments" and Section 23 09 93.11 "Sequence of Operations for HVAC DDC."
12. Flow Measurement Port: Pressure measurement taps installed in fan inlet to detect and signal airflow readings to temperature-control systems. Control devices and sequence of operation are specified in Section 23 09 23.14 "Flow Instruments" and Section 23 09 93.11 "Sequence of Operations for HVAC DDC."
13. Shaft Seal: Elastomeric seal and PTFE wear plate, suitable for up to 300 deg F.
14. Motor Cover: Cover with side vents to dissipate motor heat, of same material as housing.
15. Inlet Bell: Curved inlet for when fan is not attached to duct, of same material as housing.
16. Inlet Cone: Round-to-round transition, of same material as housing.
17. Outlet Cone: Round-to-round transition, of same material as housing.
18. Stack Cap: Vertical discharge assembly with backdraft dampers, of same material as housing.
19. Direct-Driven Units: Encase motor in housing outside of airstream. Extend lubrication lines to outside of casing and terminate with grease fittings.
20. Factory-wired motor disconnect switch located on outside of fan housing.

I. Factory Finishes:

1. Sheet Metal Parts: Prime coat before final assembly.
2. Exterior Surfaces: Baked-enamel finish coat after assembly.
3. Coatings: Powder-baked enamel;
 - a. Apply to finished housings.
 - b. Apply to fan wheels.

2.4 SOURCE QUALITY CONTROL

- 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. AMCA Compliance:
 1. Comply with AMCA performance requirements and bear the AMCA-Certified Ratings Seal.
- C. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans in accordance with AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.
- D. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings in accordance with AMCA 210/ASHRAE 51, "Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating."

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install axial fans level and plumb.
- B. Disassemble and reassemble units, as required for moving to the final location, in accordance with manufacturer's written instructions.
- C. Lift and support units with manufacturer's designated lifting or supporting points.
- D. Equipment Mounting:
 - 1. Install fans on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified in Section 03 30 00 "Cast-in-Place Concrete."
 - 2. Comply with requirements for vibration isolation and seismic-control devices specified in Section 23 05 48 "Vibration and Seismic Controls for HVAC."
 - 3. Comply with requirements for vibration isolation devices specified in Section 23 05 48.13 "Vibration Controls for HVAC."
- E. Install units with adequate clearances for service and maintenance.
- F. Label fans in accordance with requirements specified in Section 23 05 53 "Identification for HVAC Piping and Equipment."
- G. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 23 33 00 "Air Duct Accessories."

3.2 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.
- D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.
 - 1. Nameplate shall be laminated acrylic or melamine plastic signs, as specified in Section 26 05 53 "Identification for Electrical Systems."
 - 2. Nameplate shall be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch high.

3.3 CONTROL CONNECTIONS

- A. Install control and electrical power wiring to field-mounted control devices.
- B. Connect wiring in accordance with Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- C. Perform tests and inspections.
 - 1. Fan Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Fans and components will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports.

3.5 CLEANING

- A. After completing system installation and testing, adjusting, and balancing and after completing startup service, clean fans internally to remove foreign material and construction dirt and dust.

3.6 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain axial HVAC fans.

END OF SECTION

SECTION 23 34 16 - CENTRIFUGAL HVAC FANS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Square in-line centrifugal fans.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Include diagrams for power, signal, and control wiring.
 - 4. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
 - 5. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
- C. Sustainable Design Submittals:
 - 1. Product data showing compliance with ASHRAE 62.1.
- D. Delegated-Design Submittal: For unit hangars and supports 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. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.

1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Fan room layout and relationships between components and adjacent structural and mechanical elements, drawn to scale, and coordinated with each other, using input from installers of the items involved.
- B. Seismic Qualification Data: For fans, accessories, and components, from manufacturer.

- C. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 SQUARE IN-LINE CENTRIFUGAL FANS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Twin City Fans
 - 2. Greenheck Fan Corporation.
 - 3. Loren Cook Company.
- B. Description: Square in-line centrifugal fans.
- C. Housing:
 - 1. Housing Material: Reinforced steel.
 - 2. Housing Coating: None.
 - 3. Housing Construction: Side panels shall be easily removable for service. Include inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.
- D. Direct-Drive Units: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing; with wheel, inlet cone, and motor on swing-out service door.
- E. Belt-Driven Units: Motor mounted on adjustable base, with adjustable sheaves, enclosures around belts within fan housing, and lubricating tubes from fan bearings extended to outside of fan housing.
- F. Fan Wheels: Aluminum airfoil blades welded to aluminum hub.
- G. Accessories:
 - 1. Access for Inspection, Cleaning, and Maintenance: Comply with requirements in ASHRAE 62.1.
 - 2. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
 - 3. Volume-Control Damper: Manually operated with quadrant lock, located in fan outlet.
 - 4. Companion Flanges: For inlet and outlet duct connections.

5. Fan Guards: 1/2- by 1-inch mesh of galvanized steel in removable frame. Provide guard for inlet or outlet for units not connected to ductwork.
6. Motor and Drive Cover (Belt Guard): Epoxy-coated steel.
7. Side Discharge: Flange connector and attachment hardware to provide right-angle discharge on side of unit.

2.2 MOTORS

- A. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 23 05 13 "Common Motor Requirements for HVAC Equipment."
- B. Where variable-frequency drives are indicated or scheduled, provide fan motor compatible with variable-frequency drive.

2.3 SOURCE QUALITY CONTROL

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- B. AMCA Compliance: Fans shall comply with AMCA 11 and bear the AMCA-Certified Ratings Seal.
- C. Fan Sound Ratings: Comply with AMCA 311 and label fans with the AMCA-Certified Ratings Seal. Sound ratings shall comply with AMCA 301. The fans shall be tested according to AMCA 300.
- D. Fan Performance Ratings: Comply with AMCA 211 and label fans with AMCA-Certified Rating Seal. The fans shall be tested for air performance - flow rate, fan pressure, power, fan efficiency, air density, speed of rotation, and fan efficiency - according to AMCA 210/ASHRAE 51.
- E. Operating Limits: Classify fans according to AMCA 99.

PART 3 - EXECUTION

3.1 INSTALLATION OF CENTRIFUGAL HVAC FANS

- A. Install centrifugal fans level and plumb.
- B. Disassemble and reassemble units, as required for moving to the final location, according to manufacturer's written instructions.
- C. Lift and support units with manufacturer's designated lifting or supporting points.
- D. Equipment Mounting:

1. Support duct-mounted and other hanging centrifugal fans directly from the building structure, using suitable hanging systems as specified in Section 23 05 29 "Hangers and Supports for HVAC Piping and Equipment."
- E. Install units with clearances for service and maintenance.
- F. Label fans according to requirements specified in Section 23 05 53 "Identification for HVAC Piping and Equipment."

3.2 DUCTWORK AND PIPING CONNECTIONS

- A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 23 33 00 "Air Duct Accessories."
- B. Install ducts adjacent to fans to allow service and maintenance.
- C. Install piping from scroll drain connection, with trap with seal equal to 1.5 times specified static pressure, to nearest floor drain with pipe sizes matching the drain connection.
- D. Install heat tracing on all drain piping subject to freezing temperature and as indicated on Drawings. Furnish and install heat tracing according to Section 23 05 33 "Heat Tracing for HVAC Piping."

3.3 ELECTRICAL CONNECTIONS

- A. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."
- B. Ground equipment according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."
- C. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.
 1. Nameplate shall be laminated acrylic or melamine plastic signs, as specified in Section 26 05 53 "Identification for Electrical Systems."
 2. Nameplate shall be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch high.

3.4 CONTROL CONNECTIONS

- A. Install control and electrical power wiring to field-mounted control devices.
- B. Connect control wiring according to Section 26 05 23 "Control-Voltage Electrical Power Cables."

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- C. Perform tests and inspections.
- D. Tests and Inspections:
 - 1. Verify that shipping, blocking, and bracing are removed.
 - 2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
 - 3. Verify that there is adequate maintenance and access space.
 - 4. Verify that cleaning and adjusting are complete.
 - 5. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
 - 6. Adjust belt tension.
 - 7. Adjust damper linkages for proper damper operation.
 - 8. Verify lubrication for bearings and other moving parts.
 - 9. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
 - 10. See Section 23 05 93 "Testing, Adjusting, and Balancing For HVAC" for testing, adjusting, and balancing procedures.
 - 11. Remove and replace malfunctioning units and retest as specified above.
- E. Test and adjust controls and safeties. Controls and equipment will be considered defective if they do not pass tests and inspections.
- F. Prepare test and inspection reports.

3.6 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Adjust belt tension.
- C. Comply with requirements in Section 23 05 93 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.
- D. Replace fan and motor pulleys as required to achieve design airflow.
- E. Lubricate bearings.

3.7 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain centrifugal fans.

END OF SECTION

SECTION 23 34 23 - HVAC POWER VENTILATORS

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. Ceiling-mounted ventilators.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Include diagrams for power, signal, and control wiring.
 - 4. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints.
- C. Delegated-Design Submittal: For unit hangars and supports 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. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Floor plans, reflected ceiling plans, and other details, or BIM model, drawn to scale and coordinated with all building trades.
- B. Seismic Qualification Data: For fans, accessories, and components, from manufacturer.
- C. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 CEILING-MOUNTED VENTILATORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Twin City Fans
 - 2. Greenheck Fan Corporation.
 - 3. Loren Cook Company.
- B. Housing: Steel, lined with acoustical insulation.
- C. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel removable for service.
- D. Back-draft damper: Integral.
- E. Grille: Aluminum, louvered grille with flange on intake and thumbscrew or spring retainer attachment to fan housing.
- F. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.
- G. Accessories:
 - 1. Variable-Frequency Motor Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
 - 2. Manual Starter Switch: Single-pole rocker switch assembly with cover and pilot light.
 - 3. Time-Delay Switch: Assembly with single-pole rocker switch, timer, and cover plate.
 - 4. Motion Sensor: Motion detector with adjustable shutoff timer.
 - 5. Ceiling Radiation Damper: Fire-rated assembly with ceramic blanket, stainless steel springs, and fusible link.
 - 6. Filter: Washable aluminum to fit between fan and grille.
 - 7. Isolation: Rubber-in-shear vibration isolators.
 - 8. Manufacturer's standard roof jack or wall cap, and transition fittings.

2.2 SOURCE QUALITY CONTROL

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- B. AMCA Certification: Fans shall comply with AMCA 11 and bear the AMCA-Certified Ratings Seal.
- C. Fan Sound Ratings: Comply with AMCA 311, and label fans with the AMCA-Certified Ratings Seal. Sound ratings shall comply with AMCA 301. The fans shall be tested according to AMCA 300.
- D. Fan Performance Ratings: Comply with AMCA 211 and label fans with AMCA-Certified Rating Seal. The fans shall be tested for air performance - flow rate, fan pressure, power, fan efficiency, air density, speed of rotation, and fan efficiency - according to AMCA 210/ASHRAE 51.
- E. Operating Limits: Classify according to AMCA 99.
- F. UL Standards: Power ventilators shall comply with UL 705. Power ventilators for use for restaurant kitchen exhaust shall also comply with UL 762.

PART 3 - EXECUTION

3.1 INSTALLATION OF HVAC POWER VENTILATORS

- A. Ceiling Units: Suspend units from structure; use steel wire or metal straps.
- B. Support suspended units from structure using threaded steel rods and elastomeric hangers having a static deflection of 1 inch.
- C. Install units with clearances for service and maintenance.
- D. Label units according to requirements specified in Section 23 05 53 "Identification for HVAC Piping and Equipment."

3.2 DUCTWORK CONNECTIONS

- A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 23 33 00 "Air Duct Accessories."

3.3 ELECTRICAL CONNECTIONS

- A. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

- B. Ground equipment according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."
- C. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.
 - 1. Nameplate shall be laminated acrylic or melamine plastic signs, as specified in Section 26 05 53 "Identification for Electrical Systems."
 - 2. Nameplate shall be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch high.

3.4 CONTROL CONNECTIONS

- A. Install control and electrical power wiring to field-mounted control devices.
- B. Connect control wiring according to Section 26 05 23 "Control-Voltage Electrical Power Cables."

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- C. Perform tests and inspections.
- D. Tests and Inspections:
 - 1. Verify that shipping, blocking, and bracing are removed.
 - 2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
 - 3. Verify that there is adequate maintenance and access space.
 - 4. Verify that cleaning and adjusting are complete.
 - 5. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
 - 6. Adjust belt tension.
 - 7. Adjust damper linkages for proper damper operation.
 - 8. Verify lubrication for bearings and other moving parts.
 - 9. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
 - 10. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
 - 11. Shut unit down and reconnect automatic temperature-control operators.
 - 12. Remove and replace malfunctioning units and retest as specified above.

- E. Test and adjust controls and safeties. Controls and equipment will be considered defective if they do not pass tests and inspections.
- F. Prepare test and inspection reports.

3.6 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Adjust belt tension.
- C. Comply with requirements in Section 23 05 93 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.
- D. Replace fan and motor pulleys as required to achieve design airflow.
- E. Lubricate bearings.

3.7 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain centrifugal fans.

END OF SECTION

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SECTION 23 37 13.13 - AIR DIFFUSERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Round ceiling diffusers.
2. Rectangular and square ceiling diffusers.
3. Perforated diffusers.
4. Louver face diffusers.
5. Linear bar diffusers.
6. Linear slot diffusers.

B. Related Requirements:

1. Section 23 33 00 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers.
2. Section 23 37 13.23 "Air Registers and Grilles" for adjustable-bar register and grilles, fixed-face registers and grilles, and linear bar grilles.
3. Section 23 37 13.43 "Security Registers and Grilles" for security registers and security grilles.
4. Section 23 37 16 "Fabric Air-Diffusion Devices" for continuous tubular diffusers.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 ROUND CEILING DIFFUSERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. METALAIRE, Inc.
2. Nailor Industries Inc.
3. Price Industries.

- B. Devices shall be specifically designed for variable-air-volume flows.
- C. Material: Steel.
- D. Finish: Baked enamel, white.

- E. Face Style: Four cone.
- F. Mounting: Duct connection.
- G. Pattern: Fully adjustable.
- H. Accessories:
 - 1. Equalizing grid.
 - 2. Plaster ring.
 - 3. Safety chain.
 - 4. Wire guard.
 - 5. Sectorizing baffles.
 - 6. Operating rod extension.

2.2 RECTANGULAR AND SQUARE CEILING DIFFUSERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. METALAIRE, Inc.
 - 2. Nailor Industries Inc.
 - 3. Price Industries.
- B. Devices shall be specifically designed for variable-air-volume flows.
- C. Material: Steel.
- D. Finish: Baked enamel, white.
- E. Face Size: 24 by 24 inches 20 by 20 inches 12 by 12 inches.
- F. Face Style: Three cone.
- G. Mounting: Surface, T-bar, Mounting panel.
- H. Pattern: Fixed.
- I. Dampers: None.
- J. Accessories:
 - 1. Equalizing grid.
 - 2. Plaster ring.
 - 3. Safety chain.
 - 4. Wire guard.
 - 5. Sectorizing baffles.
 - 6. Operating rod extension.

2.3 PERFORATED DIFFUSERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. METALAIRE, Inc.
 - 2. Nailor Industries Inc.
 - 3. Price Industries.
- B. Devices shall be specifically designed for variable-air-volume flows.
- C. Material: Steel backpan and pattern controllers, with steel face.
- D. Finish: Baked enamel, white.
- E. Face Size: 12 by 12 inches 24 by 12 inches 36 by 12 inches 16 by 16 inches 20 by 20 inches 24 by 24 inches.
- F. Duct Inlet: Round.
- G. Face Style: Flush.
- H. Mounting: Surface, T-bar, Mounting Panel.
- I. Pattern Controller: None.
- J. Dampers: None
- K. Accessories:
 - 1. Equalizing grid.
 - 2. Plaster ring.
 - 3. Safety chain.
 - 4. Wire guard.
 - 5. Sectorizing baffles.
 - 6. Operating rod extension.

2.4 LOUVER FACE DIFFUSERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. METALAIRE, Inc.
 - 2. Nailor Industries Inc.
 - 3. Price Industries.
- B. Devices shall be specifically designed for variable-air-volume flows.
- C. Material: Steel.

- D. Finish: Baked enamel, white.
- E. Face Size: Per Plan and Schedules.
- F. Mounting: Surface with beveled frame, T-bar, Mounting panel.
- G. Pattern: Adjustable core style.
- H. Dampers: None.
- I. Accessories:
 - 1. Square to round neck adaptor.
 - 2. Adjustable pattern vanes.
 - 3. Throw reducing vanes.
 - 4. Equalizing grid.
 - 5. Plaster ring.
 - 6. Safety chain.
 - 7. Wire guard.
 - 8. Sectorizing baffles.
 - 9. Operating rod extension.

2.5 LINEAR BAR DIFFUSERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. METALAIRE, Inc.
 - 2. Nailor Industries Inc.
 - 3. Price Industries.
- B. Devices shall be specifically designed for variable-air-volume flows.
- C. Material: Steel.
- D. Finish: Baked enamel, color selected by Architect.
- E. Narrow Core Spacing Arrangement: 1/8-inch-thick blades spaced 1/4 inch apart; zero-degree deflection.
- F. Wide Core Spacing Arrangement: 1/8-inch-thick blades spaced 1/2 inch apart; zero-degree deflection.
- G. Wide Core Spacing Arrangement: 3/16-inch-thick blades spaced 1/2 inch apart; zero-degree deflection.
- H. Pencil-Proof Core Spacing Arrangement: 3/16-inch-thick blades spaced 7/16 inch apart; zero-degree deflection.
- I. One-Way Deflection Vanes: Extruded construction fixed louvers with removable core.

- J. Frame: 3/4 inch wide.
- K. Mounting: Concealed bracket.
- L. Damper Type: Adjustable opposed-blade assembly.
- M. Accessories: Plaster frame.

2.6 LINEAR SLOT DIFFUSERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. METALAIRE, Inc.
 - 2. Nailor Industries Inc.
 - 3. Price Industries.
- B. Devices shall be specifically designed for variable-air-volume flows.
- C. Material - Shell: Steel, insulated.
- D. Material - Pattern Controller and Tees: Aluminum.
- E. Finish - Face and Shell: Baked enamel, black.
- F. Finish - Pattern Controller: Baked enamel, black.
- G. Finish - Tees: Baked enamel, color selected by Architect.
- H. Slot Width: 1/2 inch.
- I. Number of Slots: Two.
- J. Length: 48 inches.
- K. Accessories: T-bar slot.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install diffusers level and plumb.
- B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in

lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

- C. Install diffusers with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.2 ADJUSTING

- A. After installation, adjust diffusers to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION

SECTION 23 37 13.23 - REGISTERS AND GRILLES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fixed face registers and grilles.
- B. Related Requirements:
 - 1. Section 23 33 00 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to registers and grilles.
 - 2. Section 23 37 13.13 "Air Diffusers" for various types of air diffusers.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 REGISTERS

- A. Fixed Face Register:
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Krueger.
 - b. Nailor Industries Inc.
 - c. Price Industries.
 - 2. Material: Steel.
 - 3. Finish: Baked enamel, white.
 - 4. Mounting: Lay in.

2.2 GRILLES

- A. Fixed Face Grille:
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

- a. Krueger.
 - b. Nailor Industries Inc.
 - c. Price Industries.
2. Material: Steel.
3. Finish: Baked enamel, white.
4. Mounting: Lay in.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install registers and grilles level and plumb.
- B. Outlets and Inlets Locations: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- C. Install registers and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.2 ADJUSTING

- A. After installation, adjust registers and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION

SECTION 23 41 00 - PARTICULATE AIR FILTRATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal panel filters.
2. Flat panel filters.
3. Pleated panel filters.
4. Nonsupported bag filters.
5. Rigid cell box filters.
6. V-bank cell filters.
7. Self-supported pocket filters.
8. Front- or back-access filter frames.
9. Side-access filter housings.
10. Filter gauges.

B. Related Requirements:

1. Section 23 31 19 "HVAC Casings" for customized housings used for particulate air filters.
2. Section 23 34 16 "Centrifugal HVAC Fans" for customized fan and filter units.
3. Section 23 41 33 "High-Efficiency Particulate Air Filtration" for HEPA filters used in combination with particulate air filters.
4. Section 23 43 00 "Electronic Air Cleaners" for electronic units combined with particulate filters as part of a system.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For air filters. Include plans, elevations, sections, details, and attachments to other work.

1. Show filter rack assembly, dimensions, materials, and methods of assembly of components.
2. Include setting drawings, templates, and requirements for installing anchor bolts and anchorages.

1.3 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Data: Certificates, for filters, accessories, and components from manufacturer.

- B. Product test reports.
- C. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each type of filter and rack to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An NRTL.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Filters shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. The term "withstand" means "the unit will remain in place without separation of any parts when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
 - 2. Component Importance Factor: 1.5.
- B. ASHRAE Compliance:
 - 1. Comply with applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality"; Section 5 - "Systems and Equipment"; and Section 7 - "Construction and Startup."
 - 2. Comply with ASHRAE 52.2 for MERV for methods of testing and rating air-filter units.
- C. Comply with NFPA 90A and NFPA 90B.
- D. Comply with UL 900.
- E. 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.

2.2 METAL PANEL FILTERS

- A. Description: Factory-fabricated, self-supported, cleanable, all-metal, impingement-type, panel-type, permanent air filters with holding frames.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AAF International.
 - b. Camfil Farr.
 - c. Tri-Dim Filter Corporation.
- B. Media: Minimum of three alternate layers of stainless-steel flat and herringbone or serpentine-crimp mesh screen.
 1. Non-oiled for grease removal application.
 2. Adhesive coating.
- C. Filter-Media Frame: Stainless steel, hinged, and with pull and retaining handles fastened to the media.
 1. Drain holes.
- D. Efficiency: Minimum 90 percent efficiency on particles 10 microns and larger.

2.3 FLAT PANEL FILTERS

- A. Description: Factory-fabricated, self-supported, flat, nonpleated, panel-type, disposable air filters with holding frames.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AAF International.
 - b. Flanders Corporation.
 - c. Tri-Dim Filter Corporation.
- B. Media: Interlaced glass or Cotton and synthetic fibers coated with nonflammable adhesive.
 1. Media shall be coated with an antimicrobial agent.
 2. Metal Retainer: Upstream side and downstream side.
- C. Filter-Media Frame: Cardboard with perforated metal retainer sealed or bonded to the media.

2.4 PLEATED PANEL FILTERS

- A. Description: Factory-fabricated, self-supported, extended-surface, pleated, panel-type, disposable air filters with holding frames.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. AAF International.
 - b. Camfil Farr.
 - c. Flanders Corporation.
 - d. Tri-Dim Filter Corporation.
- B. Media: Interlaced glass or Cotton and synthetic fibers coated with nonflammable adhesive. Coat media with an antimicrobial agent.
 - 1. Separators shall be bonded to the media to maintain pleat configuration.
 - 2. Welded-wire grid shall be on downstream side to maintain pleat.
 - 3. Media shall be bonded to frame to prevent air bypass.
 - 4. Support members on upstream and downstream sides to maintain pleat spacing.
- C. Filter-Media Frame: Cardboard frame with perforated metal retainer Galvanized steel Aluminized steel with metal grid on outlet side and steel rod grid on inlet side, hinged, with pull and retaining handles sealed or bonded to the media.

2.5 NONSUPPORTED BAG FILTERS

- A. Description: Factory-fabricated, dry, extended-surface, nonsupported filters with header frames.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AAF International.
 - b. Camfil Farr.
 - c. Tri-Dim Filter Corporation.
- B. Media: Glass-fiber material constructed so individual pockets are maintained in tapered form under rated-airflow conditions by flexible internal supports. Coat media with an antimicrobial agent.
- C. Filter-Media Frame: Galvanized steel.

2.6 RIGID CELL BOX FILTERS

- A. Description: Factory-fabricated, adhesive-coated, disposable, packaged air filters with media perpendicular to airflow, and with holding frames.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AirGuard; Clarcor Air Filtration Products, Inc.
 - b. Camfil Farr.
 - c. Flanders Corporation.

- B. Media: Fibrous material constructed so individual pleats are maintained in tapered form under rated-airflow conditions by flexible internal supports. Coat media with antimicrobial agent.
- C. Filter-Media Frames: Galvanized steel.

2.7 V-BANK CELL FILTERS

- A. Description: Factory-fabricated, adhesive-coated, disposable, packaged air filters with media angled to airflow, and with holding frames.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AAF International.
 - b. Camfil Farr.
 - c. Flanders Corporation.
 - d. Tri-Dim Filter Corporation.
- B. Media: Fibrous material constructed so individual mini-pleats are maintained in tapered form under rated-airflow conditions by flexible internal supports. Coat media with an antimicrobial agent.
- C. Filter-Media Frames: HIPS.

2.8 SELF-SUPPORTED POCKET FILTERS

- A. Description: Factory-fabricated, panel-type, disposable air filters with contoured, self-supported media for extended surface.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. AAF International.
- B. Media: Fibrous material constructed so individual pleats are maintained in tapered form under rated-airflow conditions by flexible internal supports. Coat media with an antimicrobial agent.
- C. Configuration: Single-pocket cube.
- D. Filter-Media Frame: Galvanized steel.

2.9 FRONT- OR BACK-ACCESS FILTER FRAMES

- A. Description: Galvanized-steel framing members with access for either upstream (front) or downstream (back) filter servicing, cut to size and prepunched for assembly into

modules. Vertically support filters to prevent deflection of horizontal members without interfering with filter installation or operation.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AAF International.
 - b. Flanders Corporation.
- B. Prefilters: Incorporate a separate track with spring clips, removable from front or back.
- C. Sealing: Factory-installed, positive-sealing device for each row of filters, to ensure seal between gasketed filter elements and to prevent bypass of unfiltered air.

2.10 SIDE-ACCESS FILTER HOUSINGS

- A. Description: Factory-assembled, side-service housings, constructed of galvanized steel, with flanges to connect to duct or casing system.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AAF International.
 - b. Camfil Farr.
 - c. Flanders Corporation.
 - B. Prefilters: Integral tracks to accommodate 2-inch-thick, disposable or washable filters.
 - C. Access Doors: Hinged, with continuous gaskets on perimeter and positive-locking devices, and arranged so filter cartridges can be loaded from either access door.
 - D. Sealing: Incorporate positive-sealing gasket material on channels to seal top and bottom of filter cartridge frames and to prevent bypass of unfiltered air.

2.11 FILTER GAUGES

- A. Diaphragm-type gauge with dial and pointer in metal case, vent valves, black figures on white background, and front recalibration adjustment.
 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Dwyer Instruments, Inc.
 2. Diameter: 4-1/2 inches.
 3. Scale Range for Filter Media Having a Recommended Final Resistance of 0.5-Inch wg or Less: 0- to 0.5-inch wg.
 4. Scale Range for Filter Media Having a Recommended Final Resistance of 0.5- to 1.0-Inch wg or Less: 0- to 1.0-inch wg.

5. Scale Range for Filter Media Having a Recommended Final Resistance of 1.0- to 2.0-Inch wg or Less: 0- to 2.0-inch wg.
 6. Scale Range for Filter Media Having a Recommended Final Resistance of 2.0- to 3.0-Inch wg or Less: 0- to 3.0-inch wg.
 7. Scale Range for Filter Media Having a Recommended Final Resistance of 3.0- to 4.0-Inch wg or Less: 0- to 4.0-inch wg.
- B. Manometer-Type Filter Gauge: Molded plastic, with epoxy-coated aluminum scale and logarithmic-curve tube gage with integral leveling gage, graduated to read from 0- to 3.0-inch wg, and accurate within 3 percent of the full-scale range.
- C. Accessories: Static-pressure tips, tubing, gauge connections, and mounting bracket.

PART 3 - EXECUTION

3.1 INSTALLATION OF FILTERS

- A. Position each filter unit with clearance for normal service and maintenance. Anchor filter holding frames to substrate.
- B. Install filters in position to prevent passage of unfiltered air.
- C. Install filter gauge for each filter bank.
- D. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing with new, clean filters.
- E. Coordinate filter installations with duct and air-handling-unit installations.

3.2 INSTALLATION OF FILTER GAUGES

- A. Install filter gauge for each filter bank.
- B. Install filter-gauge, static-pressure tips upstream and downstream from filters. Install filter gauges on filter banks with separate static-pressure taps upstream and downstream from filters. Mount filter gauges on outside of filter housing or filter plenum in an accessible position. Adjust and level inclined gauges.

3.3 CONTROL CONNECTIONS

- A. Install control and electrical power wiring to field-mounted control devices.
- B. Connect control wiring between pressure sensors and DDC system.
- C. Connect control wiring between controlled devices.
- D. Connect control wiring according to Section 26 05 23 "Control-Voltage Electrical Power Cables."

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- C. Perform tests and inspections.
- D. Tests and Inspections:
 - 1. Test for leakage of unfiltered air while system is operating.
- E. Air filter will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.

3.5 CLEANING

- A. After completing system installation and testing, adjusting, and balancing of air-handling and air-distribution systems, clean filter housings and install new filter media.

END OF SECTION

SECTION 23 74 16.13 - PACKAGED, LARGE-CAPACITY, ROOFTOP AIR-CONDITIONING UNITS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes packaged, large-capacity, rooftop air conditioning units (RTUs) with the following components:
 - 1. Casings.
 - 2. Fans, drives, and motors.
 - 3. Coils.
 - 4. Refrigerant circuit components.
 - 5. Air filtration.
 - 6. Gas furnaces.
 - 7. Dampers.
 - 8. Electrical power connections.
 - 9. Controls.
 - 10. Roof curbs.
 - 11. Accessories.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of RTU.
- B. Shop Drawings: For each packaged, large-capacity, rooftop air-conditioning units.
 - 1. Include plans, elevations, sections, and mounting details.
 - 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Include diagrams for power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For manufacturer's warranty.
- B. Source quality-control reports.
- C. System startup reports.
- D. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For RTUs to include in emergency, operation, and maintenance manuals.

1.5 WARRANTY

- A. Warranty: Manufacturer agrees to repair or replace components of outdoor, semi-custom, air-handling unit that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: 1 year(s) from date of Substantial Completion.
 - 2. Warranty Period for Heat Exchangers: Manufacturer's standard, but not less than five years from date of Substantial Completion

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 application.
- B. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of RTUs and components.
- C. ASHRAE 62.1 Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
- D. ASHRAE 15 Compliance: For refrigeration system safety.
- E. UL Compliance: Comply with UL 1995.

2.2 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Daikin Applied.
 - 2. Trane.
 - 3. YORK; brand of Johnson Controls International plc, Building Solutions North America.

2.3 UNIT CASINGS

- A. General Fabrication Requirements for Casings: Formed and reinforced double-wall insulated panels, fabricated to allow removal for access to internal parts and components, with joints between sections sealed.
- B. Double-Wall Construction:
 - 1. Outside Casing Wall: Galvanized steel, minimum **[18 gauge]** thick with manufacturer's standard finish, with pitched roof panels and knockouts with grommet seals for electrical and piping connections and lifting lugs.
 - 2. Inside Casing Wall: G90-coated galvanized steel, 0.034 inch thick.
 - 3. Floor Plate: G90 galvanized steel, minimum 18 gauge thick.
 - 4. Casing Insulation:
 - a. Materials: Injected polyurethane foam insulation.
 - b. Casing Panel R-Value: Minimum R-6.
 - c. Insulation Thickness: 1 inch.
 - d. Thermal Break: Provide continuity of insulation with no through-casing metal in casing walls, floors, or roof of unit.
- C. Airstream Surfaces: Surfaces in contact with airstream shall comply with requirements in ASHRAE 62.1.
- D. Static-Pressure Classifications:
 - 1. For Unit Sections Upstream of Fans: Minus 2-inch wg.
 - 2. For Unit Sections Downstream and Including Fans: 2-inch wg.
- E. Panels and Doors:
 - 1. Panels:
 - a. Fabrication: Formed and reinforced with same materials and insulation thickness as casing.
 - b. Fasteners: Two or more camlock type for panel lift-out operation. Arrangement shall allow panels to be opened against air-pressure differential.
 - c. Gasket: Neoprene, applied around entire perimeters of panel frames.
 - d. Size: Large enough to allow inspection and maintenance of air-handling unit's internal components. Dimensions to be at least 18 inches wide by full height of unit casing up to a maximum height of 60 inches.
 - 2. Access Doors:
 - a. Hinges: A minimum of two ball-bearing hinges or stainless steel piano hinge and two wedge-lever-type latches, operable from inside and outside. Arrange doors to be opened against air-pressure differential.
 - b. Gasket: Neoprene, applied around entire perimeters of panel frames.

- c. Size: Large enough to allow inspection and maintenance of air-handling unit's internal components. Dimensions to be at least 18 inches wide by full height of unit casing up to a maximum height of 60 inches.
- 3. Locations and Applications:
 - a. Fan Section: Doors and inspection and access panels.
 - b. Access Section: Doors.
 - c. Coil Section: Inspection and access panels.
 - d. Damper Section: Inspection and access panels.
 - e. Filter Section: Doors large enough to allow periodic removal and installation of filters.
 - f. Mixing Section: Doors.
- 4. Service Light: 100-W vaporproof fixture with switched junction box located outside adjacent to door.
 - a. Locations: Each section accessed with door.
- F. Condensate Drain Pans:
 - 1. Location: Each type of cooling coil.
 - 2. Construction:
 - a. Single-wall, stainless steel sheet.
 - 3. Drain Connection:
 - a. Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan.
 - b. Minimum Connection Size: NPS 1.
 - 4. Slope: Minimum 0.125-in./ft. slope, to comply with ASHRAE 62.1, in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and from humidifiers and to direct water toward drain connection.
 - 5. Width: Entire width of water producing device.
 - 6. Depth: A minimum of 2 inches deep.
 - 7. Units with stacked coils shall have an intermediate drain pan to collect condensate from top coil.

2.4 FANS, DRIVES, AND MOTORS

- A. Fan and Drive Assemblies: Statically and dynamically balanced and designed for continuous operation at maximum-rated fan speed and motor horsepower.
- B. Supply-Air Fans: Centrifugal, rated according to AMCA 210; galvanized or painted steel; mounted on solid-steel shaft.
 - 1. Shafts: With field-adjustable alignment.

- a. Turned, ground, and polished hot-rolled steel with keyway.
- 2. Shaft Bearings:
 - a. Heavy-duty, self-aligning, pillow-block type with an L-50 rated life of minimum 100,000 hours according to ABMA 9.
- 3. Housings: Formed- and reinforced-steel panels to form curved scroll housings with shaped cutoff and spun-metal inlet bell.
 - a. Bracing: Steel angle or channel supports for mounting and supporting fan scroll, wheel, motor, and accessories.
- 4. Centrifugal Fan Wheels: Inlet flange, backplate, and shallow blades with inlet and tip curved forward in direction of airflow and mechanically fastened to flange and backplate; steel or aluminum hub swaged to backplate and fastened to shaft with setscrews.
- 5. Mounting: For internal vibration isolation. Factory-mount fans with manufacturer's standard vibration isolation mounting devices having a minimum static deflection of 1 inch.
- 6. Shaft Lubrication Lines: Extended to a location outside the casing.
- 7. Flexible Connector: Factory fabricated with a fabric strip minimum 3-1/2 inches wide, attached to two strips of minimum 2-3/4-inch-wide by 0.028-inch-thick, galvanized-steel sheet.
 - a. Flexible Connector Fabric: Glass fabric, double coated with neoprene. Fabrics, coatings, and adhesives shall comply with UL 181, Class 1.
- C. Drives, Direct: Factory-mounted, direct drive.
- D. Drives, Belt: Factory-mounted, V-belt drive, with adjustable alignment and belt tensioning, and with 1.5 service factor based on fan motor.
 - 1. Pulleys: Cast iron or cast steel with split, tapered bushing, dynamically balanced at the factory.
 - 2. Belts: Oil resistant, non-sparking and nonstatic; in matched sets for multiple-belt drives.
 - 3. Belt Guards: Comply with requirements specified by OSHA and fabricate according to SMACNA's "HVAC Duct Construction Standards"; 0.146-inch-thick, 3/4-inch diamond-mesh wire screen, welded to steel angle frame; prime coated.
- E. Condenser-Coil Fan: Variable-speed propeller, mounted on shaft of permanently lubricated ECM motors.
- F. Relief-Air Fan: Propeller, shaft mounted on **permanently lubricated** motor.
- G. Motors:

1. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 23 05 13 "Common Motor Requirements for HVAC Equipment."
2. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
3. Enclosure Type: Open, dripproof.
4. Motor Pulleys: Adjustable pitch for use with 5-hp motors and smaller; fixed pitch for use with motors larger than 5 hp. Select pulley size so pitch adjustment is at the middle of adjustment range at fan design conditions.
5. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in electrical Sections.

2.5 COILS

A. General Requirements for Coils:

1. Comply with AHRI 410.
2. Fabricate coils section to allow removal and replacement of coil for maintenance and to allow in-place access for service and maintenance of coil(s).
3. Coils shall not act as structural component of unit.

B. Supply-Air Refrigerant Coil:

1. Tubes: Copper.
2. Fins:
 - a. Material: Aluminum.
3. Fin and Tube Joints: Mechanical bond.
4. Ratings: Designed, tested, and rated according to ASHRAE 33 and AHRI 410.
 - a. Working Pressure: Minimum 300 psig.

2.6 REFRIGERANT CIRCUIT COMPONENTS

A. Compressor: Hermetic, variable speed scroll, mounted on vibration isolators; with internal overcurrent and high-temperature protection, internal pressure relief, and crankcase heater.

B. Refrigeration Specialties:

1. Refrigerant: R-410A.
2. Expansion valve with replaceable thermostatic element.
3. Refrigerant filter/dryer.
4. Manual-reset high-pressure safety switch.
5. Automatic-reset low-pressure safety switch.
6. Minimum off-time relay.
7. Automatic-reset compressor motor thermal overload.

8. Brass service valves installed in compressor suction and liquid lines.
9. Low-ambient kit high-pressure sensor.
10. Four-way reversing valve with a replaceable magnetic coil, thermostatic expansion valves with bypass check valves, and a suction line accumulator.

2.7 AIR FILTRATION

- A. Particulate air filtration is specified in Section 23 41 00 "Particulate Air Filtration."
- B. Panel Filters:
 1. Description: Pleated factory-fabricated, self-supported, disposable air filters with holding frames.
 2. Filter Unit Class: UL 900.
 3. Media: Interlaced glass, synthetic or cotton fibers coated with nonflammable adhesive and antimicrobial coating.
 4. Filter-Media Frame: Beverage board with perforated metal retainer, or metal grid, on outlet side.

2.8 GAS FURNACES

- A. Description: Factory assembled, piped, and wired; complying with ANSI Z21.47/CSA 2.3 and NFPA 54.
- B. CSA Approval: Designed and certified by and bearing label of CSA.
- C. Burners: Stainless steel.
 1. Rated Minimum Turndown Ratio: 30 to 1.
 2. Fuel: Natural gas.
 3. Ignition: Electronically controlled electric spark or hot-surface igniter with flame sensor.
 4. Gas Control Valve: Single stage.
 5. Gas Train: Single-body, regulated, redundant, 24-V ac gas valve assembly containing pilot solenoid valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff.
 6. High-Altitude Kit: For Project elevations more than 2000 feet above sea level.
- D. Heat-Exchanger and Drain Pan: Stainless steel.
- E. Venting, Gravity: Gravity vented.
- F. Venting, Power: Power vented, with integral, motorized centrifugal fan interlocked with gas valve.
- G. Safety Controls:
 1. Gas Manifold: Safety switches and controls complying with ANSI standards and FM Global.

2.9 DAMPERS

- A. Outdoor- and Return-Air Dampers: Low-leakage, double-skin, airfoil-blade, galvanized-steel dampers with compressible jamb seals and extruded-vinyl blade edge seals in parallel-blade arrangement with zinc-plated steel operating rods rotating in sintered bronze or nylon bearings mounted in a single galvanized-steel frame, and with operating rods connected with a common linkage. Leakage rate shall not exceed 4 cfm/sq. ft. at 1-inch wg and 8 cfm/sq. ft. at 4-inch wg
- B. Barometric relief dampers.
- C. Electronic Damper Operators:
 - 1. Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.
 - 2. Electronic damper position indicator shall have visual scale indicating percent of travel and 2- to 10-V dc, feedback signal.
 - 3. Operator Motors:
 - a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 23 05 13 "Common Motor Requirements for HVAC Equipment."
 - b. Size to operate with sufficient reserve power to provide smooth modulating action or two-position action.
 - c. Permanent Split-Capacitor or Shaded-Pole Type: Gear trains completely oil immersed and sealed. Equip spring-return motors with integral spiral-spring mechanism in housings designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.
 - 4. Nonspring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running torque of 150 in. x lbf and breakaway torque of 300 in. x lbf.
 - 5. Spring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running and breakaway torque of 150 in. x lbf.
 - 6. Size dampers for running torque calculated as follows:
 - a. Parallel-Blade Damper with Edge Seals: 7 inch-lb/sq. ft. of damper.
 - b. Opposed-Blade Damper with Edge Seals: 5 inch-lb/sq. ft. of damper.
 - c. Parallel-Blade Damper without Edge Seals: 4 inch-lb/sq. ft. of damper.
 - d. Opposed-Blade Damper without Edge Seals: 3 inch-lb/sq. ft. of damper.
 - e. Dampers with 2- to 3-Inch wg of Pressure Drop or Face Velocities of 1000 to 2500 fpm: Increase running torque by 1.5.
 - f. Dampers with 3- to 4-Inch wg of Pressure Drop or Face Velocities of 2500 to 3000 fpm: Increase running torque by 2.0.
 - 7. Coupling: V-bolt and V-shaped, toothed cradle.
 - 8. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
 - 9. Fail-Safe Operation: Mechanical, spring-return mechanism with external, manual gear release on nonspring-return actuators.

10. Power Requirements (Modulating): Maximum 10 VA at 24 V ac or 8 W at 24 V dc.
11. Proportional Signal: 2 to 10 V dc or 4 to 20 mA, and 2- to 10-V dc position feedback signal.
12. Temperature Rating: Minus 22 to plus 122 deg F.
13. Run Time: 12 seconds open, 5 seconds closed.

2.10 ELECTRICAL POWER CONNECTIONS

- A. RTU shall have a single connection of power to unit with unit-mounted disconnect switch accessible from outside unit and control-circuit transformer with built-in overcurrent protection.

2.11 CONTROLS

- A. DDC Controller:
 1. Controller shall have volatile-memory backup.
 2. Safety Control Operation:
 - a. Smoke Detectors: Stop fan and close outdoor-air damper if smoke is detected. Provide additional contacts for alarm interface to fire alarm control panel.
 - b. Firestats: Stop fan and close outdoor-air damper if air greater than 130 deg F enters unit. Provide additional contacts for alarm interface to fire alarm control panel.
 - c. Low-Discharge Temperature: Stop fan and close outdoor-air damper if supply air temperature is less than 40 deg F.
 3. Unoccupied Period:
 - a. Heating Setback: Plus 10 deg F.
 - b. Cooling Setback: System off.
 4. Supply Fan Operation:
 - a. Occupied Periods: Run fan continuously.
 - b. Unoccupied Periods: Cycle fan to maintain setback temperature.
 5. Refrigerant Circuit Operation:
 - a. Occupied Periods: Cycle or stage compressors to match compressor output to cooling load to maintain room temperature. Cycle condenser fans to maintain maximum hot-gas pressure. Operate low-ambient control kit to maintain minimum hot-gas pressure.
 - b. Switch reversing valve for heating or cooling mode on air-to-air heat pump.
 6. Gas Furnace Operation:

- a. Occupied Periods: Modulate burner to maintain room temperature.
 - b. Unoccupied Periods: Cycle burner to maintain setback temperature.
- 7. Economizer Outdoor-Air Damper Operation:
 - a. Morning warm up cycles.
 - b. Occupied Periods: Open to 25 percent fixed minimum intake, and maximum 100 percent of the fan capacity. Controller shall permit air-side economizer operation when outdoor air is less than 60 deg F. Use mixed-air temperature and select between outdoor-air and return-air enthalpy to adjust mixing dampers. Start relief-air fan with end switch on outdoor-air damper. During economizer cycle operation, lock out cooling.
 - c. Unoccupied Periods: Close outdoor-air damper and open return-air damper.
- 8. Terminal-Unit Relays:
 - a. Provide heating- and cooling-mode changeover relays compatible with terminal control system required in Section 23 36 00 "Air Terminal Units" and Section 23 09 23 "Direct Digital Control (DDC) System for HVAC."
- B. Interface Requirements for HVAC Instrumentation and Control System:
 - 1. Interface relay for scheduled operation.
 - 2. Interface relay to provide indication of fault at the central workstation and diagnostic code storage.
 - 3. Provide BACnet or LonWorks compatible interface for central HVAC control workstation for the following:
 - a. Adjusting set points.
 - b. Monitoring supply fan start, stop, and operation.
 - c. Inquiring data to include outdoor-air damper position, supply- and room-air temperature.
 - d. Monitoring occupied and unoccupied operations.
 - e. Monitoring constant and variable motor loads.
 - f. Monitoring variable-frequency drive operation.
 - g. Monitoring cooling load.
 - h. Monitoring economizer cycles.
 - i. Monitoring air-distribution static pressure and ventilation air volume.

2.12 ROOF CURBS

- A. Materials: Galvanized steel with corrosion-protection coating, watertight gaskets, and factory-installed wood nailer; complying with NRCA standards.
 - 1. Curb Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.
 - a. Materials: ASTM C 1071, Type I or II.
 - b. Thickness: 1 inch.

2. Application: Factory applied with adhesive and mechanical fasteners to the internal surface of curb.
 - a. Liner Adhesive: Comply with ASTM C916, Type I.
 - b. Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in cabinet.
 - c. Liner materials applied in this location shall have air-stream surface coated with a temperature-resistant coating or faced with a plain or coated fibrous mat or fabric depending on service air velocity.
 - d. Liner Adhesive: Comply with ASTM C916, Type I.
- B. Curb Dimensions: Height of 24 inches.

2.13 ACCESSORIES

- A. Electric heater with integral thermostat maintains minimum 50 deg F temperature in gas burner compartment.
- B. Duplex, 115-V, ground-fault-interrupter outlet with 15-A overcurrent protection. Include transformer if required.
- C. Filter differential pressure switch with sensor tubing on either side of filter. Set for final filter pressure loss.
- D. Remote potentiometer to adjust minimum economizer damper position.
- E. Return-air bypass damper.
- F. Factory- or field-installed demand-controlled ventilation.
- G. Safeties:
 1. Smoke detector.
 2. Condensate overflow switch.
 3. Phase-loss reversal protection.
 4. High and low pressure control.
 5. Gas furnace airflow-proving switch.
- H. Coil guards of painted, galvanized-steel wire.
- I. Door switches to disable heating or reset set point when open.
- J. Outdoor air intake weather hood with moisture eliminator.
- K. Service Lights and Switch: Factory installed in each accessible section with weatherproof cover. Factory wire lights to a single-point field connection.

2.14 MATERIALS

- A. Steel:
 - 1. ASTM A36/A36M for carbon structural steel.
 - 2. ASTM A568/A568M for steel sheet.
- B. Stainless Steel:
 - 1. Manufacturer's standard grade for casing.
 - 2. Manufacturer's standard type, ASTM A240/A240M for bare steel exposed to airstream or moisture.
- C. Galvanized Steel: ASTM A653/A653M.
- D. Aluminum: ASTM B209.
- E. Comply with Section 23 05 46 "Coatings for HVAC" for corrosion-resistant coating.

2.15 SOURCE QUALITY CONTROL

- A. AHRI Compliance:
 - 1. Comply with AHRI 340/360 for testing and rating energy efficiencies for RTUs.
 - 2. Comply with AHRI 270 for testing and rating sound performance for RTUs.
 - 3. Comply with AHRI 1060 for testing and rating performance for air-to-air exchanger.
- B. AMCA Compliance:
 - 1. Comply with AMCA 11 and bear the AMCA-Certified Ratings Seal for air and sound performance according to AMCA 211 and AMCA 311.
 - 2. Damper leakage tested in accordance with AMCA 500-D.
 - 3. Operating Limits: Classify according to AMCA 99.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Examine roughing-in for RTUs to verify actual locations of piping and duct connections before equipment installation.
- B. Roof Curb: Install on roof structure or concrete base, level and secure, according to AHRI Guideline B. Secure RTUs to upper curb rail, and secure curb base to roof framing or concrete base with anchor bolts. Coordinate sizes and locations of roof curbs with actual equipment provided.

3.2 PIPING CONNECTIONS

- A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where installing piping adjacent to RTU, allow space for service and maintenance.
- C. Connect piping to unit mounted on vibration isolators with flexible connectors.
- D. Connect condensate drain pans using NPS 1-1/4, ASTM B88, Type M copper tubing. Extend to nearest equipment or roof drain. Construct deep trap at connection to drain pan and install cleanouts at changes in direction.
- E. Gas Piping: Comply with applicable requirements in Section 23 11 23 "Facility Natural-Gas Piping." Connect gas piping to burner, full size of gas train inlet, and connect with union and shutoff valve with sufficient clearance for burner removal and service.
- F. Hot- and Chilled-Water Piping: Comply with applicable requirements in Section 23 21 13 "Hydronic Piping" and Section 23 21 16 "Hydronic Piping Specialties." Install shutoff valve and union or flange at each coil supply connection. Install balancing valve and union or flange at each coil return connection.
- G. Refrigerant Piping: Comply with applicable requirements in Section 23 23 00 "Refrigerant Piping." Install shutoff valve and union or flange at each supply and return connection.

3.3 DUCT CONNECTIONS

- A. Comply with duct installation requirements specified in other HVAC Sections. Drawings indicate the general arrangement of ducts. The following are specific connection requirements:
 - 1. Install ducts to termination at top of roof curb.
 - 2. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.
 - 3. Connect supply ducts to RTUs with flexible duct connectors specified in Section 23 33 00 "Air Duct Accessories."
 - 4. Install return-air duct continuously through roof structure.

3.4 ELECTRICAL CONNECTIONS

- A. Connect electrical wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."
- B. Ground equipment according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."

- C. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.
- D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.
 - 1. Nameplate shall be laminated acrylic or melamine plastic signs as specified in Section 26 05 53 "Identification for Electrical Systems."
 - 2. Locate nameplate where easily visible.

3.5 CONTROL CONNECTIONS

- A. Install control and electrical power wiring to field-mounted control devices.
- B. Connect control wiring according to Section 26 05 23 "Control-Voltage Electrical Power Cables."

3.6 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. After installing RTUs and after electrical circuitry has been energized, test units for compliance with requirements.
 - 2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
 - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. RTU will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain RTUs.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes split-system air-conditioning and heat-pump units consisting of separate evaporator-fan and compressor-condenser components.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1.3 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

- 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. ASHRAE Compliance:
 - 1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."
- C. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.

1. Warranty Period:
 - a. For Compressor: Five year(s) from date of Substantial Completion.
 - b. For Parts: One year(s) from date of Substantial Completion.
 - c. For Labor: One year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Daikin AC.
2. Mitsubishi Electric & Electronics USA, Inc.
3. Trane.

2.2 INDOOR UNITS (5 TONS OR LESS)

- A. Concealed Evaporator-Fan Components:
1. Chassis: Galvanized steel with flanged edges, removable panels for servicing, and insulation on back of panel.
 2. Insulation: Faced, glass-fiber duct liner.
 3. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 206/110.
 4. Electric Coil: Helical, nickel-chrome, resistance-wire heating elements; with refractory ceramic support bushings, automatic-reset thermal cutout, built-in magnetic contactors, manual-reset thermal cutout, airflow proving device, and one-time fuses in terminal box for overcurrent protection.
 5. Fan: Forward-curved, double-width wheel of galvanized steel; directly connected to motor.
 6. Fan Motors:
 - a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Section 23 05 13 "Common Motor Requirements for HVAC Equipment."
 - b. Multitapped, multispeed with internal thermal protection and permanent lubrication.
 - c. Wiring Terminations: Connect motor to chassis wiring with plug connection.
 7. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
 8. Filters: Permanent, cleanable.
 9. Condensate Drain Pans:

- a. Fabricated with two percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and humidifiers, and to direct water toward drain connection.
 - 1) Depth: A minimum of 2 inches deep.
- b. Single-wall, stainless-steel sheet.
- c. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan.
 - 1) Minimum Connection Size: NPS 1.
- d. Units with stacked coils shall have an intermediate drain pan to collect condensate from top coil.

2.3 OUTDOOR UNITS (5 TONS OR LESS)

A. Air-Cooled, Compressor-Condenser Components:

- 1. Casing: Steel, finished with baked enamel in color selected by Architect, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
- 2. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation device. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
 - a. Compressor Type: Scroll.
 - b. Refrigerant: R-410A.
 - c. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and liquid subcooler. Comply with ARI 206/110.
- 3. Heat-Pump Components: Reversing valve and low-temperature-air cutoff thermostat.
- 4. Fan: Aluminum-propeller type, directly connected to motor.
- 5. Motor: Permanently lubricated, with integral thermal-overload protection.
- 6. Low Ambient Kit: Permits operation down to 45 deg F.
- 7. Mounting Base: Polyethylene.

2.4 ACCESSORIES

- A. Thermostat: Low voltage with subbase to control compressor and evaporator fan.
- B. Automatic-reset timer to prevent rapid cycling of compressor.

- C. Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.
- D. Drain Hose: For condensate.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install units level and plumb.
- B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.
- C. Equipment Mounting:
 - 1. Install ground-mounted, compressor-condenser components on cast-in-place concrete equipment base(s).
 - 2. Comply with requirements for vibration isolation devices specified in Section 23 05 48.13 "Vibration Controls for HVAC."
- D. Install and connect precharged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.
- C. Duct Connections: Duct installation requirements are specified in Section 23 31 13 "Metal Ducts." Drawings indicate the general arrangement of ducts. Connect supply[**and return**] ducts to split-system air-conditioning units with flexible duct connectors. Flexible duct connectors are specified in Section 23 33 00 "Air Duct Accessories."

3.3 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 motor rotation and unit operation.
 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Remove and replace malfunctioning units and retest as specified above.
- D. Prepare test and inspection reports.

3.4 DEMONSTRATION

- A. **[Engage a factory-authorized service representative to train] [Train]** Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION

SECTION 23 82 39.19 - WALL AND CEILING UNIT HEATERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes wall and ceiling heaters with propeller fans and electric-resistance heating coils.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include rated capacities, operating characteristics, furnished specialties, and accessories.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, and details.
 - 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Include details of anchorages and attachments to structure and to supported equipment.
 - 4. Include equipment schedules to indicate rated capacities, operating characteristics, furnished specialties, and accessories.
 - 5. Wiring Diagrams: Power, signal, and control wiring.
- C. Samples: For each exposed product and for each color and texture specified.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. INDEECO.
 - 2. Markel Products Company; a subsidiary of TPI Corporation.
 - 3. Marley Engineered Products.

2.2 DESCRIPTION

- A. Assembly including chassis, electric heating coil, fan, motor, and controls. Comply with UL 2021.
- B. 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.

2.3 CABINET

- A. Front Panel: Stamped-steel louver, with removable panels fastened with tamperproof fasteners.
- B. Finish: Baked enamel over baked-on primer with manufacturer's standard color selected by Architect, applied to factory-assembled and -tested wall and ceiling heaters before shipping.
- C. Surface-Mounted Cabinet Enclosure: Steel with finish to match cabinet.

2.4 COIL

- A. Electric-Resistance Heating Coil: Nickel-chromium heating wire, free from expansion noise and 60-Hz hum, embedded in magnesium oxide refractory and sealed in corrosion-resistant metallic sheath. Terminate elements in stainless-steel, machine-staked terminals secured with stainless-steel hardware, and limit controls for high-temperature protection. Provide integral circuit breaker for overcurrent protection.

2.5 FAN AND MOTOR

- A. Fan: Aluminum propeller directly connected to motor.
- B. Motor: Permanently lubricated, multispeed. Comply with requirements in Section 23 05 13 "Common Motor Requirements for HVAC Equipment."

2.6 CONTROLS

- A. Controls: Unit-mounted thermostat. Low-voltage relay with transformer kit.
- B. Electrical Connection: Factory wire motors and controls for a single field connection with disconnect switch.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install wall and ceiling unit heaters to comply with NFPA 90A.
- B. Install wall and ceiling unit heaters level and plumb.
- C. Install wall-mounted thermostats and switch controls in electrical outlet boxes at heights to match lighting controls. Verify location of thermostats and other exposed control sensors with Drawings and room details before installation.
- D. Ground equipment according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."
- E. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

END OF SECTION

SECTION 260500 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. General provisions.
 - 2. Scope.
 - 3. Permits and Fees.
 - 4. Visit to Job Site.
 - 5. Workmanship.
 - 6. Drawings and Specifications.
 - 7. Tests.
 - 8. Allowance for added work.
 - 9. Incidental construction work.
 - 10. Access Doors.
 - 11. Supervision.
 - 12. Electrical work by others.
 - 13. Existing facilities, utilities, etc.
 - 14. Adaptation of work to existing conditions.
 - 15. Renovations/alterations.
 - 16. Submittal procedures.
 - 17. Product requirements.
 - 18. Closeout procedures.
 - 19. Operation and Maintenance Manuals.
 - 20. As-built Documents.
 - 21. Demonstration and Training.
 - 22. Warranty.

PART 2 - NOT APPLICABLE

PART 3 - EXECUTION

3.1 GENERAL PROVISIONS

- A. This Contractor's attention is directed to the requirements of Instructions to Bidders, General Conditions and Supplementary General Conditions as bound in the specifications which apply in full to the ELECTRICAL work.
- B. Where the requirements of this Division conflict with other articles in these Specifications, the Contractor shall utilize the more stringent method.

3.2 SCOPE

- A. Provide all labor, materials, tools, equipment, and transportation, and perform all operations necessary for and reasonably incidental to proper execution and completion of all "ELECTRICAL" work, whether specifically mentioned or not, all as indicated, specified herein, and/or implied thereby to carry out the apparent intent thereof.
- B. These drawings may be superseded by later revised or detailed drawings, specifications, or sketches prepared by the Designer, as needed for clarification, and this Contractor shall conform to all reasonable coordination requests.
- C. All items not specifically mentioned in the specifications or noted on the drawings, but which obviously are required to make the working installation complete, shall be included automatically.
- D. For projects which are bid or awarded as Single Prime contracts, organization of the Specifications into divisions, sections, and articles, and arrangement of the Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be done by any trade, unless specifically shown or noted otherwise.
- E. All work to be per current National Electric Code and relative NFPA Sections.

3.3 PERMITS AND FEES

- A. This Contractor shall secure all permits required for the completion of this contract. He shall obtain and deliver to the Owner all certificates of inspection issued by the authorities having jurisdiction.

3.4 VISIT TO JOB SITE

- A. Before submitting a bid, this Contractor shall visit the job site for the purpose of thoroughly examining the site and conditions under which the work must be performed.
- B. The submission of a bona fide bid will be construed to mean that this Contractor understands and is satisfied with conditions under which the contract must be fulfilled.
- C. No extra compensation will be allowed for situations arising from failure of this Contractor to be thoroughly familiar with site conditions, including charges and requirements for connection to utilities as shown for this project.

3.5 WORKMANSHIP

- A. Workmanship in the fabrication, preparation, and installation of materials and equipment shall conform to the best standards of practice of the trades involved.
- B. Work shall be performed by experienced and skilled mechanics under the supervision of a competent foreman.
- C. Substandard workmanship will be cause for rejection of work and replacement by Contractor.

- D. The Contractor shall reimburse the Designer for all costs incurred by the Designer due to Contractor's substandard or non-conforming work.

3.6 DRAWINGS AND SPECIFICATIONS

- A. The drawings show the location and arrangement of fixtures, piping, and equipment, together with details of connections of certain principal items.
- B. The layout shown shall be followed as closely as circumstances will permit, but this Contractor shall lay out his work so as to avoid conflict with other Contractors and trades, and to avoid any unnecessary cutting or damage to walls, floors, and supporting structural members.
- C. This Contractor shall carefully and accurately locate all sleeves and install at the proper time all necessary hangers, inserts, etc., which will be required for the completion of his work, and shall be solely responsible for the accurate and proper location of above items.
- D. This Contractor shall refer to architectural, mechanical, and electrical drawings and shall cooperate fully with other Contractors and trades while installing piping, fixtures, and other equipment because of close space limits.
 - 1. In case of conflict, notify Designer before proceeding with installation.
 - 2. Refer to architectural drawings for exact building dimensions and location of partition walls, doors, chases, etc.
 - 3. ELECTRICAL drawings are not to be scaled for such dimensions.
- E. The drawings and specifications complement each other and together are intended to give a complete description of the work.
 - 1. Any item of equipment or note of work to be done as shown on plans and not mentioned in the specifications, or mentioned in specifications and not shown in plans, shall be furnished the same as if mentioned or shown in both places.
 - 2. If conflicts exist, then the most stringent method shown or described shall apply.
- F. Any switches, controls, or equipment included in this contract work (drawings and/or specifications) that are not specifically shown on drawings shall be located for convenient use and access.
- G. Contractor shall coordinate all equipment arrangement and lay-out in field prior to beginning any actual installation of his work.
- H. If Contractor notes any discrepancy, omission, or conflict found in plans or specifications, he shall call to the immediate attention of the Designer, prior to receipt of bids.
- I. It is the intention that piping, air ducts and light fixtures are designed and laid out to clear each other.
 - 1. It shall be the responsibility of this Contractor to coordinate his work with that of other trades to avoid any such conflicts.
 - 2. Any conflicts that occur after work of one trade is installed and was not prior coordinated shall be relocated or rearranged at the total expense of this Contractor, as directed by Designer.
 - 3. Any conflicts that cannot be corrected in field by relocation or elevation changes shall be reported to the Designer in writing prior to any installation.

- J. The drawings are not intended to show each and every complete or accurate detail.
 - 1. The figures and writing on drawings shall be taken instead of scaling.
 - 2. It is this Contractor's responsibility to comply with the evident intent for centering and symmetric arrangement.
 - 3. This Contractor shall take and be responsible for all field measurements.
 - 4. Exact locations and relations are to be defined in the field and shall be satisfactory to the Designer.
- K. Because of the small scale of ELECTRICAL drawings it is not possible to indicate all offsets, fittings, and accessories which may be required.
 - 1. Investigate structural and finish conditions affecting this work and arrange work accordingly, providing such fittings and accessories that may be required to meet the conditions.

3.7 TESTS

- A. The Designer reserves the right to conduct acceptance tests of all equipment, piping, or any other work furnished under these specifications to determine the fulfillment of special requirements.
 - 1. Such tests shall be conducted in the presence of authorized representatives of the Contractor, Owner, Engineer, and Architect at such time as the Designer may designate.
 - 2. This Contractor shall perform all tests, bear cost of same and make adjustments of equipment and wiring as may be deemed necessary by the Designer.

3.8 ALLOWANCE FOR ADDED WORK

- A. Before proceeding with any work for which compensation may be claimed or the Owner may claim credit, a detailed estimate shall first be submitted and approved in writing.
 - 1. No claim for addition to the contract sum will be valid unless so ordered and approved by the Owner and Designer, prior to start of work.
 - 2. Any conflicts corrected by relocation or elevation changes do not constitute extra work.

3.9 INCIDENTAL CONSTRUCTION WORK

- A. All blocking for openings for piping in concrete floors, masonry walls or partitions shall be provided by this Contractor.
 - 1. This Contractor shall do all cutting and fitting of his work and of other work that may be required to make the several parts come together properly and to fit his work to receive or be received by the work of other Contractors as shown upon, or reasonably implied by the drawings and specifications.
 - 2. He shall properly complete and finish up his work after other Contractors have finished as the Designer may direct.
- B. All excavating required for the installation of this system shall be done by this Contractor.
 - 1. Backfill shall be accomplished as specified in appropriate section of specifications.
- C. Chases are prohibited in masonry walls which are not to be plastered or paneled.

1. Set piping, blocking, carriers, etc. indicated to be concealed before walls are constructed in order that walls may be constructed around them.
 2. This Contractor shall furnish all sleeves in floors, beams, walls, etc., for each such penetration as needed for installing his work and installation of sleeves by General Contractor.
- D. Unless otherwise noted, the General Contractor will provide openings and lintels as new construction progresses, but this Contractor shall fully designate his requirements prior to construction.
1. Failure to furnish his requirements prior to building construction and failure to coordinate his work with the building construction shall make this Contractor responsible for removing, replacing and painting building construction as required for installation of his work.

3.10 ACCESS DOORS

- A. Provide and install access doors in walls, ceilings, etc. as required for access to junction boxes, terminal cabinets, controls, and other devices requiring access in ceilings, chases, soffits, etc.
- B. Access doors in non-fire rated walls or ceilings shall be as follows:
1. Nominal 24" x 24" minimum size.
 2. 16-gage steel frame with 14-gage door panel and galvanized steel drywall bead.
 3. Flush style with provision to conceal flange with drywall cement.
 4. Double-acting concealed spring hinges to allow opening to 175 degrees.
 5. Flush, Allen-head operated with steel cam.
 6. Gray prime-painted steel, for painting to match adjacent finished surfaces.
 7. Basis of Design: Milcor Style DW; Comparable Products by Karp, Elmdor, Acudor.
- C. Access doors in fire-rated walls or ceilings shall be as follows:
1. Nominal 24" x 24" minimum size.
 2. UL 1-1/2 hour, Class B fire rating.
 3. Prime-painted stainless steel: 16-gage frame with 20-gage door panel, for painting to match adjacent finished surfaces.
 4. 2" mineral fiber insulation between inner and outer panel.
 5. Continuous hinge, steel with stainless steel pin.
 6. Self-closing and self-latching panel closer.
 7. Flush mounted paddle latch and locking system with flush, key-operated cylinder lock with two keys.
 8. Basis of Design: Milcor Style UFR; Comparable Products by Karp, Elmdor, Acudor.

3.11 SUPERVISION

- A. This Contractor shall have in charge of the work at all times during construction a thoroughly competent foreman with extensive experience in the work to be performed under this contract.
1. Anyone deemed not capable by the Designer shall be replaced immediately upon request, and after satisfactory foreman has been assigned, he shall not be withdrawn without the written consent of the Designer.

3.12 ELECTRICAL WORK BY OTHERS

- A. Refer to the drawings for the details of locations of circuit breakers, junction boxes, disconnect switches, conduits and slack wire required where this contractor's electrical work terminates and electrical work by others begins.
- B. The Electrical Contractor shall furnish and install all power circuits for equipment furnished by others.
- C. In Mechanical Rooms the wiring by the Electrical Contractor shall generally terminate in a power wiring gutter, line side of disconnect switches or starters, junction box, or electrical panel.
 - 1. From these points power wiring to the equipment furnished by the ELECTRICAL Contractor shall generally be by the ELECTRICAL Contractor.
 - 2. Power wiring to mechanical equipment outside equipment rooms will generally be run by the Electrical Contractor to line side of a disconnect switch or junction box in the vicinity (within 3'-0") of the ELECTRICAL equipment.
 - 3. Power wiring from that point to the equipment will be by the ELECTRICAL Contractor.
- D. ELECTRICAL Contractor is to refer to the drawings for location and type of service connections to be provided under the electrical contract.
 - 1. Where service disconnect switches are required and not furnished as part of the equipment, they shall be furnished and installed by contractor that furnishes the equipment, unless indicated otherwise.
 - 2. Other Contractors shall furnish and install conduit, boxes, wiring and all items of control for equipment they furnish or Owner furnished equipment, unless specifically shown on electrical drawings.

3.13 EXISTING FACILITIES

- A. In existing facilities, disruption of operations must be kept to a minimum and coordinated with Owner.
 - 1. Work in existing buildings must be cleaned up daily immediately after finishing that portion of work and equipment left in order for Owner to continue operations.
 - 2. When it is necessary to interrupt utility services in the fulfillment of this contract, such interruptions shall be kept to a minimum and coordinated with Owner.
 - 3. Once work has begun, it shall be pursued diligently until completed.
- B. Every precaution shall be taken to prevent damage to existing underground lines and structures and public utilities.
 - 1. Damage to existing water and sewer lines, culverts, service connections, underground cables, and similar surface and sub-surface structures shall be at the risk of this Contractor, whether or not locations thereof are shown on plans, and the repairing of such damage shall be by this Contractor and shall be completed without delay.
 - 2. Compensation for such repairs shall be based on normal and reasonable costs.
- C. The locations of any existing underground utilities that are shown are in an approximate way only and have not been independently verified by the Owner or its representative.

1. The Contractor shall determine the exact location of all existing utilities before commencing work, and agrees to be fully responsible for any and all damages which might be occasioned by the Contractor's failure to exactly locate and preserve any and all underground utilities.

3.14 ADAPTATION OF WORK TO EXISTING CONDITIONS

- A. It is reasonably implied that this Contractor shall furnish all labor and materials to provide Owner with a new and satisfactory system in these facilities.
 1. Contractor is to include necessary work for adaptation of equipment to conditions that may be found to produce conflicts during construction.
 2. When any such conditions are encountered, this Contractor is to consult with Designer and then modify installation as directed without additional costs, and to include any incidental materials required.

3.15 RENOVATIONS/ALTERATIONS

- A. Before any work is started in existing building, ELECTRICAL Contractor shall make a thorough survey with Designer and a representative of the Owner of building in which alterations occur and areas which are anticipated routes of access, and furnish a report, signed by all three to Designer. This report shall list by rooms and spaces:
 1. Existing conditions and types of resilient flooring, doors, windows, wall and other surfaces not required to be altered throughout and affected areas of building.
 2. Existence and conditions and operation of items such as ELECTRICAL fixtures, water heaters, valves, etc., required by drawings to be either reused for relocated, or both.
 3. Any discrepancies between drawings and existing conditions at site.
 4. Areas for working space, materials storage and routes of access to areas within buildings where alterations occur and which have been agreed upon by Contractor and Designer.
- B. Any items required by drawings to be either reused or relocated or both, found during this survey to be nonexistent, or in opinion of Designer and Owner's representative, to be in such condition that their use is impossible or impractical, shall be removed and a proposal submitted by Contractor to replace with new items in accordance with specifications which will be furnished by Designer.
- C. Re-Survey: Fifteen days before expected partial or final inspection date, Contractor, Designer, Owner's representative, together shall make a thorough re-survey of the areas of buildings involved.
 1. They shall furnish a report on conditions then existing, of ELECTRICAL fixtures, equipment, etc. as compared with conditions of same as noted in first condition survey report.
 2. Re-survey report shall also list any damage caused by this Contractor to such flooring and other surfaces, despite protection measures; and, will form basis for determining extent of repair work required of this Contractor to restore damage caused by Contractor's workmen in executing work of this Contract.

3.16 SUBMITTAL PROCEDURES

- A. Coordinate preparation and processing of submittals with performance of construction activities.
 - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 - 2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
 - 3. Designer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- B. Contractor approval: Affix review stamp to cover sheet, with initials and date of Contractor's approval of submittals.
 - 1. By submitting Shop Drawings, Product Data, Samples and similar submittals, this Contractor represents that the Contractor has determined and verified materials, field measurements and field construction criteria and details related thereto, or will do so, and has checked and coordinated the information contained within such submittals with the requirements of the Work, the Contract Documents and the Work of other trades.
- C. Comply with requirements in Division 01 Sections for list of submittals and time requirements for scheduled performance of related construction activities.
- D. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows.
 - 1. Time for review shall commence on Designer's receipt of submittal.
 - 2. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
 - 3. Allow 21 days for initial review of each submittal.
 - a. Allow additional time if coordination with subsequent submittals is required.
 - b. Designer will advise Contractor when a submittal being processed must be delayed for coordination.
 - 4. Allow 15 days for review of each resubmittal.
- E. Identification: Identify submittals as required in Division 01 sections.
- F. Deviations: Highlight, encircle, or otherwise specifically identify deviations from the Contract Documents on submittals.
 - 1. Summarize deviations on transmittal or List of Deviations included with submittal.
- G. Coordinate first paragraph and subparagraph below with office policy. Marking numerous copies of submittals can be time consuming.
- H. Transmittal: Package each submittal individually and appropriately for transmittal and handling.
 - 1. Transmit each submittal using a transmittal form.
 - 2. Designer will discard submittals received from sources other than Contractor.
- I. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
 - 1. Note date and content of previous submittal.

2. Note date and content of revision in label or title block and clearly indicate extent of revision.
 3. Resubmit submittals until they are marked "Furnish as Submitted" or "Furnish as Corrected."
 4. Where submittals contain specific questions or comments, provide a separate sheet with specific answers to each question or comment.
- J. At Contractor's written request, copies of Designer's CAD files will be provided to Contractor for Contractor's use in connection with Project, subject to the following conditions:
1. Allow 21 days from Designer's receipt of written request for CAD files for delivery of files
 2. Files will be delivered via email or compact disc.
 3. Files will be delivered without RN&M Title Blocks, standard details, schedules, etc.
 4. CAD files provided for Contractor's use are not to be construed as the Contract Documents. Use of CAD files for submittals or other uses are at the Contractor's risk.
- K. Prepare and submit Action Submittals required by individual Specification Sections.
1. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
 2. Number of Copies: Submit at least eight copies of Product Data, unless otherwise indicated.
 - a. Designer will return all but three copies.
 - b. Retain or duplicate sufficient copies for inclusion in Operation and Maintenance Manuals.
 3. Shop Drawings: Prepare Project-specific information, drawn accurately to scale.
 - a. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data, unless submittal of Designer's CAD Drawings is otherwise permitted.
 4. Revise subparagraph below to establish a standard sheet size and format.
 5. Sheet Size: At least 8-1/2 by 11 inches but no larger than size of project drawings.
 6. Subparagraph below assumes Architect and Contractor will make copies from opaque print.
 7. Number of Copies: Two opaque (bond) copies of each submittal. Designer will return one copy.
 8. Manufacturers and Materials Suppliers List: Submit three copies of manufacturers and materials suppliers list within 20 days of Contract Award, unless otherwise indicated. Designer will return two copies.
 9. If needed, combine subcontract list in paragraph below with product list above. Subcontract list is required by AIA Document A201 to be submitted as soon as practical after award of the Contract.
 10. Subcontract List: Submit within 20 days of Contract Award three copies of list of proposed subcontractors. Designer will return two copies. Subcontract list to include all tiers of subcontractors.
- L. Contractor's Review and Approval: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents.
1. Note corrections and field dimensions.
 2. Mark with approval stamp before submitting to Designer.

- M. Designer's Action: Designer will not review submittals that do not bear Contractor's approval stamp and will return them without action.
 - 1. Designer will review each submittal, make marks to indicate corrections or modifications required, and return it.
 - 2. Designer will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken, as follows:
 - a. Furnish as Submitted
 - b. Furnish as Corrected: Incorporate comments marked on or attached to submittal.
 - c. Revise and Resubmit: Major items of the submittal do not comply, requiring a resubmittal.
- N. Partial submittals are not acceptable, will be considered nonresponsive, and will be returned without review.
- O. Submittals not required by the Contract Documents may not be reviewed and may be discarded.
- P. The Contractor is responsible for compliance with the Contract Documents, dimensions, details, coordination, and satisfactory performance of materials and equipment provided and installed.

3.17 PRODUCT REQUIREMENTS

- A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - 1. Basis-of-Design Product: Item identified by manufacturer's product name, make, and model number, used to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, dimensions, and other characteristics for purposes of evaluating comparable products of other named manufacturers.
 - 2. Comparable Product: Product that is listed in the Contract Documents, or added by Addendum, and demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified or basis-of-design product.
 - 3. Owner-preferred Alternate Product: Product that is listed in the Contract Documents, and for which an Alternate Bid price is submitted. When an Alternate Bid item is accepted in the Contract, no substitutions will be allowed.
 - 4. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor after award of Contract.
 - 5. New Products: Items that have not previously been incorporated into another project or facility, except that products consisting of recycled-content materials are allowed, unless explicitly stated otherwise. Products salvaged or recycled from other projects are not considered new products.
- B. Comparable Product Requests: Submit three copies of each request for consideration, at least 10 days prior to receipt of bids, for products not listed in the Contract Documents.

Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Documentation: Show compliance with requirements for Comparable Products and the following, as applicable:
 - a. 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 product.
 - b. Detailed comparison of significant qualities of proposed product 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.
 - c. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 2. Designer's Action: If necessary, Designer will request additional information or documentation for evaluation. Designer will notify Contractor of approval or rejection of proposed comparable product request.
 - a. Form of Approval: Addition of the item to the list of Comparable Products by Addendum, prior to receipt of bids.
 - b. Use product specified if Designer cannot make a decision on use of a comparable product request within time allocated.
- C. 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.
1. Provide products complete with accessories, trim, finish, fasteners, features, options, and other items needed for a complete installation and indicated use and effect, and as required or recommended by the manufacturer for a complete installation, whether or not specifically indicated on the drawings or specifications.
 2. 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.
 3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
 4. Where products are accompanied by the term "as selected," Designer will make selection.
 5. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.
- D. Product Selection Procedures:
1. Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed that complies with requirements.
 2. Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.
 3. Basis-of-Design Product: Where Specifications name a product and include a list of manufacturers, provide the specified product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named.

- E. Responsibility of the Contractor: The responsibility for determining dimensions, utility requirements, fitting of work with other trades, sequencing and coordination of work, for Product Substitutions and Comparable Products rests solely with the Contractor.
- F. Manufacturer's Warranties: Where specifications require manufacturer's warranties, the provisions of the Contract Documents take precedence over any manufacturer's "standard" warranty provisions, exclusions, etc.
 - 1. The start of manufacturer's warranties shall be the date of Substantial Completion of the project or phase of the project, notwithstanding any language or exclusion in any document submitted by the contractor or manufacturer.

3.18 CLOSEOUT PROCEDURES

- A. Substantial Completion: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.
 - 1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
 - 2. Complete startup testing of systems.
 - 3. Submit test records.
 - 4. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
 - 5. Complete final cleaning requirements, including touchup painting.
 - 6. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
 - 7. Submit a written request for inspection for Substantial Completion. On receipt of request, Designer will either proceed with inspection or notify Contractor of unfulfilled requirements.
 - 8. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
 - 9. Results of completed inspection will form the basis of requirements for Final Completion.
- B. Final Completion: Before requesting final inspection for determining date of Final Completion, complete the following:
 - 1. Submit certified copy of Designer's Substantial Completion inspection list of items to be completed or corrected (punch list). The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 - 2. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit documentation of training.
 - 3. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Designer will either proceed with inspection or notify Contractor of unfulfilled requirements.
 - 4. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
- C. Cleaning: This Contractor shall provide all systems and equipment in a new and clean condition.
 - 1. Clean all items furnished and installed in accordance with manufacturer's recommendations.
 - 2. Provide instruction to Owner in proper cleaning of all items provided as part of this Division.

3. Cooperate with General Contractor in cleaning of building.

3.19 OPERATION AND MAINTENANCE MANUALS

- A. Submit four complete copies of Operation and Maintenance Manuals to Designer for review prior to request for inspection for Substantial Completion.
- B. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain a title page, table of contents, and manual contents.
- C. Title Page: Enclose title page in transparent plastic sleeve. Include the following information:
 1. Subject matter included in manual.
 2. Name and address of Project.
 3. Name and address of Owner.
 4. Date of submittal.
 5. Name, address, and telephone number of Contractor.
 6. Name and address of Architect.
 7. Name and address of Engineer.
- D. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
- E. List of Material Suppliers and Subcontractors: List contact information for each material supplier and subcontractor.
- F. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
 1. Binders: Heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
 - a. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.
 2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
 3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.
 4. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
 - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
 - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate

locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

- G. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.
- H. Descriptions: Include the following: Product name and model number, Manufacturer's name, Equipment identification with serial number of each component, Equipment function, Operating characteristics, Limiting conditions, Performance curves, Engineering data and tests, Complete nomenclature and number of replacement parts.
- I. Include start-up, break-in, and control procedures; stopping and normal shutdown instructions; routine, normal, seasonal, and weekend operating instructions; and required sequences for electric or electronic systems.
- J. Describe the sequence of operation, and diagram controls as installed.
- K. List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.
- L. Provide manufacturers' maintenance documentation including maintenance instructions, drawings and diagrams for maintenance, nomenclature of parts and components, and recommended spare parts for each component part or piece of equipment:
- M. Include test and inspection instructions, troubleshooting guide, disassembly instructions, and adjusting instructions that detail essential maintenance procedures:
- N. Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
- O. Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- P. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
- Q. Provide complete approved submittal data with all annotations.
- R. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in Record Drawings to ensure correct illustration of completed installation.

3.20 AS-BUILT DOCUMENTS

- A. As-built Marked Prints: Maintain one set of blue- or black-line white prints of the Contract Drawings.
1. Mark Record Prints to show the actual installation where installation varies from that shown originally.
 2. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up As-built Marked Prints.
 3. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 4. Record data as soon as possible after installation.
 5. Record and check the markup before enclosing concealed installations.
 6. Indicate dimensions to locate underground and concealed conduits and lines from fixed reference points.
 7. Indicate burial depth for underground lines.
 8. Indicate location of all valves and cross-reference to valve tag list.
 9. Mark the Contract Drawings completely and accurately.
 - a. Mark record sets with erasable, red-colored pencil.
 - b. Note Addendum numbers, Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
 10. Maintain As-built Marked Prints in a clean, legible, up-to-date condition in the project office, and available to the Designer for inspection upon request throughout construction.
 - 11.
 12. In first paragraph and subparagraphs below, architects may want to delete titleblock information from CAD files provided to Contractor. See Evaluations. Consult Owner for format required.
- B. Record Specifications: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 2. Note related Change Orders and As-built Marked Prints where applicable.

3.21 DEMONSTRATION AND TRAINING

- A. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
- B. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season. Schedule training with Owner with at least seven days' advance notice.
- C. Warranty service: Train Owner in repair and troubleshooting during each warranty service call.
- D. For each training session, submit on letterhead name of trainer, date of training, names of Owner's personnel trained, and systems/equipment trained on.

- E. For factory training, documentation to be on letterhead of organization conducting training.

3.22 WARRANTY

- A. This Contractor shall guarantee all materials, equipment, workmanship and each and every piece of apparatus which he furnished and which he installs under this contract against defects and failures of any nature for a period of one year from date on which the system is accepted.
- B. Apparatus furnished by this Contractor shall be guaranteed to be satisfactory when operated under rated conditions in accordance with manufacturer's instructions and to be of size, function, and capacity specified on drawings or in the specifications.
- C. Equipment manufacturers shall warrant equipment furnished for this project for same time span as installing contractors warranty period as set above and elsewhere in these specifications.
 - 1. Warranty start date shall be as established by the Designer. Refer to General Conditions, Supplementary General Conditions, and Division 1 specifications for establishment of warranty start dates.
 - 2. The provisions of the Contract Documents supersede and override any manufacturer's standard warranty provisions.
- D. Upon notice from the Designer or Owner, Contractor shall immediately check system, make necessary repairs or adjustments as required; due to faulty workmanship, materials, faults, operation or equipment, without cost to the Owner, and instruct Owner in proper operation, adjustment, and care of systems.
- E. During the one-year warranty period, the Contractor shall be responsible for all preventive maintenance, including routine lubrication, filter changing, inspections, and adjustments.
 - 1. Contractor shall provide all materials, consumables, equipment, supplies, etc. required for preventive maintenance.
 - 2. Perform preventive maintenance in accordance with manufacturer's recommendations.
 - 3. During preventive maintenance, instruct Owner in proper preventive maintenance procedures.
- F. The Contractor shall submit service call tickets, reports, or other documentation of each warranty service call to the Designer.

END OF SECTION 220500

SECTION 260100 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes through-penetration firestop systems for penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items.

1.2 PERFORMANCE REQUIREMENTS

- A. General: For penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.
- B. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per ASTM E 814 or UL 1479:
 - 1. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.
 - 2. T-Rated Systems: For the following conditions, provide through-penetration firestop systems with T-ratings indicated, as well as F-ratings, where systems protect penetrating items exposed to potential contact with adjacent materials in occupiable floor areas:
 - a. Penetrations located outside wall cavities.
 - b. Penetrations located outside fire-resistance-rated shaft enclosures.
- C. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.
 - 1. For floor penetrations with annular spaces exceeding **4 inches** in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved, either by installing floor plates or by other means.
- D. For through-penetration firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For each through-penetration firestop system, submit documentation, including illustrations, from a qualified testing and inspecting agency, showing each type of construction condition penetrated, relationships to adjoining construction, and type of penetrating item.
 - 1. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular through-penetration firestop condition, submit illustration, with modifications marked, approved by through-penetration firestop system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.
- C. Qualification Data: For Installer.

1.4 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Provide through-penetration firestop systems that comply with the following requirements and those specified in Part 1 "Performance Requirements" Article:
 - 1. Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL, or another agency performing testing and follow-up inspection services for firestop systems acceptable to authorities having jurisdiction.

2. Through-penetration firestop systems are identical to those tested per testing standard referenced in "Part 1 Performance Requirements" Article. Provide rated systems bearing classification marking of qualified testing and inspecting agency.
- B. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.
- C. Do not cover up through-penetration firestop system installations that will become concealed behind other construction until each installation has been examined by Owner's inspecting agency and building inspector, if required by authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the through-penetration firestop systems indicated for each application on Drawings or that are produced by one of the following manufacturers:
 1. Grace, W. R. & Co. - Conn.
 2. Hilti, Inc.
 3. Johns Manville.
 4. Nelson Firestop Products.
 5. 3M; Fire Protection Products Division.
 6. Tremco; Sealant/Weatherproofing Division.
 7. USG Corporation.

2.2 FIRESTOPPING

- A. Compatibility: Provide through-penetration firestop systems that are compatible with one another; with the substrates forming openings; and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.
- B. Accessories: Provide components for each through-penetration firestop system that are needed to install fill materials and to comply with Part 1 "Performance Requirements" Article. Use only components specified by through-penetration firestop system manufacturer and approved by qualified testing and inspecting agency for firestop systems indicated.

PART 3 - EXECUTION

3.1 THROUGH-PENETRATION FIRESTOP SYSTEM INSTALLATION

- A. General: Install through-penetration firestop systems to comply with Part 1 "Performance Requirements" Article and with firestop system manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. Install forming/damming/backing materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.
- C. Install fill materials for firestop systems by proven techniques to produce the following results:
 1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
 3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.2 FIELD QUALITY CONTROL

- A. Where deficiencies are found, repair or replace through-penetration firestop systems so they comply with requirements.
- B. Proceed with enclosing through-penetration firestop systems with other construction only after inspection reports are issued and firestop installations comply with requirements.

END OF SECTION 260100

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SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Building wires and cables rated 600 V and less.
 - 2. Connectors, splices, and terminations rated 600 V and less.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control test reports.

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.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

- A. Copper Conductors: Comply with NEMA WC 70.
- B. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN.
- C. Multiconductor Cable: Comply with NEMA WC 70 for metal-clad cable, Type MC with ground wire.

2.2 CONNECTORS AND SPLICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AFC Cable Systems, Inc.
 - 2. Hubbell Power Systems, Inc.
 - 3. O-Z/Gedney; EGS Electrical Group LLC.
 - 4. 3M; Electrical Products Division.
 - 5. Tyco Electronics Corp.
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Service Entrance: Type THHN-THWN, single conductors in raceway.
- B. Exposed Feeders: Type THHN-THWN, single conductors in raceway.
- C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN-THWN, single conductors in raceway.
- D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.
- E. Exposed Branch Circuits, Including in Crawlspace: Type THHN-THWN, single conductors in raceway.
- F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.
- G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.
- H. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.
- I. Class 1 Control Circuits: Type THHN-THWN, in raceway.

- J. Class 2 Control Circuits: Type THHN-THWN, in raceway Power-limited cable, concealed in building finishes, or Power-limited tray cable, in cable tray.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.
- B. 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.
- C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- E. Support cables according to Division 26 Sections "Hangers and Supports for Electrical Systems."
- F. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."
- G. 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.
- H. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
 - 1. Use oxide inhibitor in each splice and tap conductor for aluminum conductors.
- I. Wiring at Outlets: Install conductor at each outlet, with at least **6 inches** of slack.

3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
- B. Tests and Inspections:
 - 1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.
 - 2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 3. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in cables and conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner.
 - a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.
 - b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - c. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
- C. Test Reports: Prepare a written report to record the following:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
- D. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 260519

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes methods and materials for grounding systems and equipment.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control test reports.

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 UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Stranded Conductors: ASTM B 8.
 - 3. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, **1/4 inch** in diameter.
 - 4. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 - 5. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; **1-5/8 inches** wide and **1/16 inch** thick.

2.2 CONNECTORS

- A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.
 - 1. Pipe Connectors: Clamp type, sized for pipe.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.3 GROUNDING ELECTRODES

- A. Ground Rods: [**Copper-clad**] steel; [**3/4 inch by 10 feet**] in diameter.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger, unless otherwise indicated.
- B. Underground Grounding Conductors: Install barecopper conductor, No. 2/0 AWG minimum. Bury at least **24 inches** below grade.
- C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.
- D. Conductor Terminations and Connections:
 - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 - 2. Underground Connections: Welded connectors, except at test wells and as otherwise indicated.
 - 3. Connections to Ground Rods at Test Wells: Bolted connectors.
 - 4. Connections to Structural Steel: Welded connectors.

3.2 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
 - 1. Feeders and branch circuits.
 - 2. Lighting circuits.
 - 3. Receptacle circuits.
 - 4. Single-phase motor and appliance branch circuits.
 - 5. Three-phase motor and appliance branch circuits.
 - 6. Flexible raceway runs.
 - 7. Armored and metal-clad cable runs.
 - 8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
 - 9. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.
 - 10. X-Ray Equipment Circuits: Install insulated equipment grounding conductor in circuits supplying x-ray equipment.
- B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
- C. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
- D. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.
- E. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.
- F. Signal and Communication Equipment: For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum 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 1/4-by-2-by-12-inch grounding bus.
 - 2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.
- G. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.3 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

- B. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade, unless otherwise indicated.
 - 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating, if any.
 - 2. For grounding electrode system, 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, and connect to the service grounding electrode conductor.
 - C. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Division 26 Section "Underground Ducts and Raceways for Electrical Systems," and shall be at least 12 inches deep, with cover.
 - 1. Test Wells: Install at least one test well for each service, unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.
 - D. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.
 - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
 - 3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.
 - E. Grounding and Bonding for Piping:
 - 1. Metal Water Service Pipe: Install 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, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
 - 2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
 - 3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
 - F. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.
- 3.4 FIELD QUALITY CONTROL
- A. Perform the following tests and inspections and prepare test reports:
 - 1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
 - 2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells.
 - a. Measure ground resistance not less than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
 - b. Perform tests by fall-of-potential method according to IEEE 81.
 - B. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity 500 kVA and Less: **[10]** ohms.
 2. Power and Lighting Equipment or System with Capacity 500 to 1000 kVA: **[5]** ohms.
 3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: **[3]** ohms.
 4. Power Distribution Units or Panelboards Serving Electronic Equipment: **[3]** ohm(s).
- C. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Designer promptly and include recommendations to reduce ground resistance.
- END OF SECTION 260526

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Hangers and supports for electrical equipment and systems.
 - 2. Construction requirements for concrete bases.

1.2 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- C. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.3 SUBMITTALS

- A. Product Data: For steel slotted support systems.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following:
 - 1. Trapeze hangers. Include Product Data for components.
 - 2. Steel slotted channel systems. Include Product Data for components.
 - 3. Equipment supports.
- C. Welding certificates.

1.4 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Tube & Conduit.
 - b. Cooper B-Line, Inc.; a division of Cooper Industries.
 - c. ERICO International Corporation.
 - d. GS Metals Corp.
 - e. Thomas & Betts Corporation.
 - f. Unistrut; Tyco International, Ltd.
 - g. Wesanco, Inc.
 - 2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 - 3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
 - 4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
 - 5. Channel Dimensions: Selected for applicable load criteria.
- B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- C. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor

gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

- E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
 - 1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Hilti Inc.
 - 2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
 - 3) MKT Fastening, LLC.
 - 4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.
 - 2. Mechanical-Expansion Anchors: Insert-wedge-type, **[zinc-coated]** steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Cooper B-Line, Inc.; a division of Cooper Industries.
 - 2) Empire Tool and Manufacturing Co., Inc.
 - 3) Hilti Inc.
 - 4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
 - 5) MKT Fastening, LLC.
 - 3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
 - 4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
 - 5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
 - 6. Toggle Bolts: All-steel springhead type.
 - 7. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be **1/4 inch** in diameter.
- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
 - 1. Secure raceways and cables to these supports with **[two-bolt conduit clamps]**.
- D. Spring-steel clamps designed for supporting single conduits without bolts may be used for **1-1/2-inch** and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.
- C. 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**.
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 - 1. To Wood: Fasten with lag screws or through bolts.
 - 2. To New Concrete: Bolt to concrete inserts.
 - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 - 4. To Existing Concrete: Expansion anchor fasteners.
 - 5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete **4 inches** thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than **4 inches** thick.
 - 6. To Steel: **[Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69]**.
 - 7. To Light Steel: Sheet metal screws.
 - 8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated but not less than **4 inches** larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
- B. Use **3000-psi**, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03 Section "Miscellaneous Cast-in-Place Concrete."
- C. Anchor equipment to concrete base.
 - 1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 2. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 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 minimum dry film thickness of **2.0 mils**.
- B. Touchup: Comply with requirements in Division 09 painting Sections 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 A 780.

END OF SECTION 260529

SECTION 260533 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SCOPE

- A. The work under this section includes conduits, surface raceways, multi-outlet assemblies, auxiliary gutters, wall duct, and boxes for electrical systems including wall and ceiling outlet boxes, floor boxes, and junction boxes.

1.2 SUBMITTALS

- A. Surface Raceway System - submit product data and catalog sheets for all components.
- B. Boxes - provide product data showing configurations, finishes, dimensions, and manufacturer's instructions.

PART 2 - PRODUCTS

2.1 RIGID METAL CONDUIT AND FITTINGS

- A. Conduit: Heavy wall, galvanized steel, schedule 40, threaded.
- B. Fittings and Conduit Bodies: Use all steel threaded fittings and conduit bodies.

2.2 PVC COATED RIGID METAL CONDUIT

- A. PVC Externally Coated Conduit: Rigid heavy wall, schedule 40, steel conduit with external 40 mil (0.1 mm) PVC coating. Conduit must be hot dipped galvanized inside and out including threads. The PVC coating bond to the galvanized steel conduit shall be stronger than the tensile strength of the coating itself.
- B. Fittings and Conduit Bodies: Threaded type, material to match conduit. PVC coated fittings and couplings shall have specially formed sleeves to tightly seal to conduit PVC coating. The sleeves shall extend beyond the fitting or coupling a distance equal to the pipe outside steel diameter or two inches (50 mm) whichever is greater.

2.3 INTERMEDIATE METAL CONDUIT (IMC) AND FITTINGS

- A. Conduit: Galvanized steel, threaded.
- B. Fittings and Conduit Bodies: Use all steel threaded fittings and conduit bodies.

2.4 ELECTRICAL METALLIC TUBING (EMT) AND FITTINGS

- A. Conduit: Steel, galvanized tubing.
- B. Fittings: All steel, set screw, water tight, concrete tight. No push-on or indenter types permitted.
- C. Conduit Bodies: All steel threaded conduit bodies.

2.5 FLEXIBLE METAL CONDUIT AND FITTINGS

- A. Conduit: steel, galvanized, spiral strip.
- B. Fittings and Conduit Bodies: All steel, galvanized, or malleable iron.

2.6 LIQUIDTIGHT FLEXIBLE METAL CONDUIT AND FITTINGS

- A. Conduit: flexible, steel, galvanized, spiral strip with an outer Liquidtight, nonmetallic, sunlight-resistant jacket.
- B. Fittings and Conduit Bodies: ANSI/NEMA FB 1, compression type. There shall be a metallic cover/insert on the end of the conduit inside the connector housing to seal the cut conduit end.

2.7 RIGID NONMETALLIC CONDUIT AND FITTINGS

- A. Conduit: Schedule 40 PVC minimum, Listed, sunlight resistant, rated for 90° C conductors.
- B. Fittings and Conduit Bodies: NEMA TC 2, Listed.

2.8 SURFACE METAL RACEWAY

- A. Description: Sheet metal channel with fitted cover, suitable for use as surface metal raceway.
- B. Size: As shown on Drawings.
- C. Finish: Color selection by Architect.
- D. Fittings: Couplings, elbows, and connectors designed for use with raceway system.

- E. Boxes and Extension Rings: Designed for use with raceway systems.
- 2.9 SURFACE NONMETAL RACEWAY
 - A. Description: Nonmetallic channel with fitted cover, suitable for use as surface raceway.
 - B. Size: As shown on Drawings.
 - C. Finish: Color selection by Architect.
 - D. Fittings: Couplings, elbows, and connectors designed for use with raceway system.
 - E. Boxes and Extension Rings: Designed for use with raceway systems.
- 2.10 AUXILIARY GUTTERS (Wireways)
 - A. Description: General purpose, Oil-tight and dust- tight, or Rain-tight type wireway without knockouts.
 - B. Size: Cross-section and length as indicated on drawings.
 - C. Cover: Hinged cover with full gasketing, where required by application.
 - D. Connector: [hinged cover.]
 - E. Fittings: Lay-in type with [removable top, bottom, and side; captive screws.]
 - F. Finish: Rust inhibiting primer coat with gray enamel finish.
- 2.11 OUTLET BOXES
 - A. Sheet Metal Outlet Boxes: galvanized steel, with stamped knockouts.
 - B. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 3/8 inch male fixture studs where required.
 - C. Concrete Ceiling Boxes: Concrete type.
 - D. Cast Boxes: Cast ferroalloy, or aluminum type deep type, gasketed cover, threaded hubs.
- 2.12 FLOOR BOXES
 - A. Floor Boxes for Installation in Cast-In-Place Concrete Floors: As shown and detailed on Drawings.
- 2.13 PULL AND JUNCTION BOXES
 - A. Pull boxes and junction boxes shall be minimum 4 inch square (100 mm) by 2 1/8th inches (54 mm) deep for use with 1 inch (25 mm) conduit and smaller. On conduit systems using 1 1/4 inch (31.75 mm) conduit or larger, pull and junction boxes shall be sized per NEC but not less than 4 11/16 inch square (117 mm).
 - B. For telecommunication, fiber optic, security, and other low voltage cable installations the NEC box size requirements shall apply. All boxes, used on telecommunication, security, other low voltage and fiber optic systems with conduits of 1 1/4" and larger, shall be sized per the NEC conduit requirements. For determining box size, the conduit is the determining factor not the wire size.
 - C. Sheet Metal Boxes: code gauge galvanized steel, screw covers, flanged and spot welded joints and corners.
 - D. Sheet Metal Boxes Larger Than 12 Inches (300 mm) in any dimension shall have a hinged cover or a chain installed between box and cover.
 - E. Cast Metal Boxes for Outdoor and Wet Location Installations: Type 4 and Type 6, flat-flanged, surface-mounted junction box, UL listed as raintight. Galvanized cast iron or aluminum box and cover with ground flange, neoprene gasket, and stainless steel cover screws.
 - F. Fiberglass or Concrete Handholes with weatherproof cover of non-skid finish shall be used for underground installations.
 - G. Box extensions and adjacent boxes within 48" of each other are not allowed for the purpose of creating more wire capacity.
 - H. Junction boxes 6" x 6" or larger size shall be without stamped knock-outs.
 - I. Wireways shall not be used in lieu of junction boxes.
- 2.14 GENERAL
 - A. All steel fittings and conduit bodies shall be galvanized.

- B. No cast metal, split or gland type fittings permitted.
- C. Condulets larger than 2 inch are (50 mm) not permitted except as approved or detailed.
- D. All conduit covers must be fastened to the conduit body with screws and be of the same manufacture.
- E. Wireways and gutters shall not be used in lieu of pull boxes and condulets.
- F. All boxes shall be of sufficient size to provide free space for all conductors enclosed in the box and shall comply with NEC requirements.

PART 3 - EXECUTION

3.1 CONDUIT SIZING, ARRANGEMENT, AND SUPPORT

- A. EMT is permitted to be used in sizes 4" and smaller for power and telecommunication systems. See CONDUIT INSTALLATION SCHEDULE below for other limitations for EMT and other types of conduit.
- B. Size power conductor raceways for conductor type installed. Conduit size shall be 3/4 inch minimum except as specified elsewhere. **Caution: Per the NEC, the allowable conductor ampacity is reduced when more than three current-carrying conductors are installed in a raceway. Contractor must take the NEC ampacity adjustment factors into account when sizing the raceway and wiring system.**
- C. Size conduit for all other wiring, including but not limited to data, control, security, fire alarm, telecommunications, signal, video, etc. shall be sized per number of conductors pulled and their cross-section. 40% fill shall be maximum for all new conduit fills.
- D. Arrange conduit to maintain headroom and present a neat appearance.
- E. Route exposed conduit and conduit above accessible ceilings parallel and perpendicular to walls and adjacent piping.
- F. Arrange conduit supports to prevent distortion of alignment by wire pulling operations. Fasten conduit using galvanized pipe straps, conduit racks (lay-in adjustable hangers), clevis hangers, or bolted split stamped galvanized hangers.
- G. Group conduit in parallel runs where practical and use conduit rack (lay-in adjustable hangers) constructed of steel channel with conduit straps or clamps. Provide space for 25 percent additional conduit.
- H. Do not fasten conduit with wire or perforated pipe straps. Before conductors are pulled, remove all wire used for temporary conduit support during construction.
- I. Support and fasten metal conduit at a maximum of 8 feet on center, and as required by NEC.
- J. Supports shall be independent of the installations of other trades, e.g. ceiling support wires, HVAC pipes, etc., unless so approved or detailed.
- K. In general, all conduits shall be concealed except where noted on the drawings or approved by the Architect/Engineer. Contractor shall verify with Architect/Engineer all surface conduit installations except in mechanical rooms.
- L. Changes in direction shall be made with symmetrical bends, cast steel boxes, stamped metal boxes or cast steel conduit bodies.
- M. No continuous conduit run shall exceed 100 feet without a junction box.

3.2 CONDUIT INSTALLATION

- A. Cut conduit square using a saw or pipecutter; de-burr cut ends.
- B. Conduit shall not be fastened to the corrugated metal roof deck.
- C. Bring conduit to the shoulder of fittings and couplings and fasten securely.
- D. Use conduit hubs for fastening conduit to cast boxes. Use sealing locknuts or conduit hubs for fastening conduit to sheet metal boxes in damp or wet locations (sheet metal boxes 4 & 11/16th" square and larger, shall contain NO pre-punched or concentric knockouts).

- E. All conduit terminations (except for terminations into conduit bodies) shall use connectors or conduit hubs with one locknut or shall use double locknuts (one each side of box wall) and insulating bushing. Provide bushings for the ends of all conduits not terminated in box walls. Refer to Division 26 Sections for grounding bushing requirements.
 - F. Install no more than the equivalent of three 90 degree bends between boxes.
 - G. Use hydraulic one-shot conduit bender or factory elbows for bends in conduit larger than 2 inch size unless sweep elbows are required.
 - H. Conduit shall be bent according to manufacturers' recommendations. Torches or open flame shall not be used to aid in bend of PVC conduit.
 - I. Use suitable conduit caps or other approved seals to protect installed conduit against entrance of dirt and moisture.
 - J. Provide 1/8 inch (3 mm) nylon pull string in empty conduit, except sleeves and nipples.
 - K. Install expansion-deflection joints where conduit crosses building expansion joints. Note: expansion-deflection joints are not required where conduit crosses building control joints if the control joint does not act as an expansion joint. Install expansion fitting in PVC conduit runs as recommended by the manufacturer.
 - L. Avoid moisture traps where possible. Where moisture traps are unavoidable, provide junction boxes with drain fittings at conduit low points.
 - M. Where conduit passes between areas of differing temperatures such as into or out of cool rooms, freezers, unheated and heated spaces, buildings, etc., provide Listed conduit seals to prevent the passage of moisture and water vapor through the conduit.
 - N. Route conduit through roof openings for piping and ductwork where possible.
 - O. Ground and bond conduit per other Division 26 Sections.
 - P. PVC conduit shall transition to galvanized rigid metal conduit before it enters a concrete pole base, foundation, wall (where exposed) or up through a concrete floor. Transition shall be under the slab or under grade, with a rigid 90-degree bend or elbow.
 - Q. Use PVC-coated rigid steel factory elbows for bends in plastic conduit larger than 2". PVC elbows are allowed in PVC conduit runs 2" and smaller.
 - R. All conduit installed underground (exterior to building) shall be buried a minimum of 24" below finished grade, whether or not the conduit is concrete encased.
 - S. PVC conduit shall be cleaned with solvent, and dried before application of glue. The temperature rating of glue/cement shall match weather condition. Apply full even coat of cement/glue to entire area that will be inserted into fitting. The entire installation shall meet manufacturers' recommendations.
 - T. Medium voltage conduit may be installed in interior locations other than electrical vaults only with special permission from Architect/Engineer.
- 3.3 CONDUIT INSTALLATION SCHEDULE
- A. Conduit other than that specified below for specific applications shall not be used.
 - B. Underground Installations within five feet of foundation fall: Rigid steel conduit.
 - C. Underground Installations more than five feet from foundation fall: Rigid steel conduit. Plastic-coated rigid steel conduit. Schedule 40 PVC conduit. Install in concrete duct bank as detailed on Drawings.
 - D. Under Slab on Grade Installations: Schedule 40 PVC conduit. Where conduit turns up through slab and is exposed, elbow shall be rigid steel conduit.
 - E. Exposed Outdoor Locations: Rigid steel conduit.
 - F. Concealed in Concrete and Block Walls: Rigid steel conduit. Schedule 40 PVC conduit. Electrical Metallic Tubing (EMT).
 - G. Wet Interior Locations: Rigid steel conduit.

- H. Concealed Dry Interior Locations: Rigid steel conduit. Intermediate metal conduit. Electrical metallic tubing.
 - I. Exposed Dry Interior Locations: Rigid steel conduit.
 - J. Motor and equipment connections: Flexible PVC coated metal conduit (wet, damp, or dry locations). Flexible metal conduit (dry locations only). Minimum length shall be one foot; maximum length shall be three feet. Conduit must be installed perpendicular to direction of equipment vibration to allow conduit to freely flex.
 - K. Light fixtures: Direct box or conduit connection for surface mounted and recessed fixtures. Flexible metal conduit (fixture whip) from a J-box for recessed lay-in light fixtures. Conduit size shall be 3/8" minimum diameter and six foot maximum length. Conduit length shall allow movement of fixture for maintenance purposes. Contractor may use Type MC metal-clad cable in lieu of conduit/wire for fixture whips, size and wire size as specified above.
 - L. Medium Voltage Applications (Interior Locations): Rigid steel conduit.
- 3.4 SURFACE METAL RACEWAY AND MULTI-OUTLET ASSEMBLY INSTALLATION
- A. Use flat-head screws to fasten channel to surfaces every twenty-four (24) inches. Mount plumb and level.
 - B. Use suitable insulating bushings and inserts at connections to outlets and corner fittings.
 - C. Maintain grounding continuity between raceway components to provide a continuous grounding path per Division 26 Sections.
 - D. Fastener Option: Use clips and straps suitable for the purpose.
- 3.5 NONMETALLIC SURFACE RACEWAY INSTALLATION
- A. Use flat headed screws with appropriate anchors to fasten channel to surfaces secured every twenty-four (24) inches. Mount plumb and level. All surface mounted devices shall be fastened to the wall utilizing flat head screws along with appropriate anchors. No device shall be adhered to the wall surface using two-faced tape or any means other than as described above.
 - B. Use suitable insulating bushings and inserts at connections to outlets and corner fittings.
 - C. In areas where the walls cannot be fished, the station cable serving these outlets shall be covered with raceways. No exposed wire shall be permitted within offices, laboratories, and conference rooms or like facilities.
 - D. The non-metallic raceway shall have a screw applied base. Both the base and cover shall be manufactured of rigid PVC materials.
 - E. The raceway shall originate from a surface mounted box mounted adjacent to and at the same height as existing electrical boxes in the room, be attached to the wall and terminate above the ceiling.
 - F. All fittings including, but not limited to, extension boxes, elbows, tees, fixture bodies shall match the color of the raceway.
 - G. The raceway and all systems devices shall be UL listed and exhibit nonflammable self extinguishing characteristics, tested to specifications of UL94V-0.
 - H. The raceway and all systems devices shall adhere to the EIA/TIA Category 5e bend radius standard.
- 3.6 AUXILIARY GUTTERS (Wireways) INSTALLATION
- A. Bolt auxiliary gutter to wall using two-piece hangers or steel channels fastened to the wall or in self-supporting structure.
 - B. Gasket each joint in oil-tight gutter.
 - C. Mount rain-tight gutter in horizontal position only.
 - D. Maintain grounding continuity between raceway components to provide a continuous grounding path under Division 26 Sections.

- E. Provide terminal blocks for wiring terminations in auxiliary gutters and wireways.
- 3.7 COORDINATION OF BOX LOCATIONS
 - A. Provide electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections, and code compliance.
 - B. Electrical box locations shown on Contract Drawings are approximate unless dimensioned. Verify location of floor boxes and outlets in offices and work areas prior to rough-in.
 - C. No outlet shall be located where it will be obstructed by other equipment, piping, lockers, benches, casework, etc.
 - D. Boxes shall not be fastened to the metal roof deck.
 - E. Contractor shall study drawings pertaining to other trades, discuss location of outlets with workmen installing other piping, equipment, casework, furnishing, etc., and fit all electrical outlets to job conditions. In case of conflicts, notify Designer prior to installation.
 - F. The proper location of each outlet is considered a part of this contract and no additional compensation will be paid to the Contractor for moving outlets which were improperly located.
 - G. Locate and install boxes to allow access to them. Where installation is inaccessible, coordinate locations and provide 18 inch by 24 inch access doors.
 - H. Locate and install to maintain headroom and to present a neat appearance.
 - I. Install boxes to preserve fire resistance rating of partitions and other elements, using approved materials and methods.
- 3.8 OUTLET BOX INSTALLATION
 - A. Do not install boxes back-to-back in walls. Provide minimum 6 inch separation, except provide minimum 24 inch separation in acoustic-rated walls.
 - B. Power: Recessed (1/4" maximum) outlet boxes in masonry, concrete or tile construction shall be masonry type, minimum 4 inch square. Device covers shall be square-cut except rounded corner plaster rings are allowed in drywall applications. Angle cut plaster rings are not permitted. Coordinate masonry cutting to achieve neat openings for boxes.
 - C. Low Voltage: Recessed (1/4" maximum) outlet boxes in masonry, concrete or tile construction shall be masonry type, minimum 4 11/16 inch square. Device covers shall be square-cut except rounded corner plaster rings are allowed in drywall applications. Angle cut plaster rings are not permitted. Coordinate masonry cutting to achieve neat openings for boxes.
 - D. Provide knockout closures for unused openings.
 - E. Support boxes independently of conduit except for cast boxes that are connected to two rigid metal conduits, both supported within 12 inches of box.
 - F. Use multiple-gang boxes where more than one device are mounted together; do not use sectional boxes. Provide non-metallic barriers to separate wiring of different voltage systems.
 - G. Install boxes in walls without damaging wall insulation.
 - H. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.
 - I. Ceiling outlets shall be 4 inch octagon or 4 inch square, minimum 2-1/8 inch deep except that concrete boxes and plates will be approved where applicable. Position outlet boxes to locate luminaires as shown on reflected ceiling plans. All ceiling outlets shall be equipped with 3/8 inch fixture studs.
 - J. In inaccessible ceiling areas, position outlets and junction boxes within 6 inches of recessed luminaire, to be accessible through luminaire ceiling opening.
 - K. Provide recessed outlet boxes in finished areas; secure boxes to interior wall and partition studs, accurately positioning to allow for surface finish thickness. Use

stamped steel stud bridges for flush outlets in hollow stud wall, and adjustable steel channel fasteners for flush ceiling outlet boxes.

- L. Align wall-mounted outlet boxes for switches, thermostats, and similar devices.
- M. Provide cast ferroalloy or aluminum outlet boxes in exterior and wet locations.
- N. Surface wall outlets shall be 4 inch square with raised covers for one and two gang requirements. For three gang or larger requirements, use gang boxes with non-overlapping covers.

3.9 FLOOR BOX INSTALLATION

- A. Set boxes level and flush with finish flooring material.

3.10 PULL AND JUNCTION BOX INSTALLATION

- A. Locate pull boxes and junction boxes above accessible ceilings, in unfinished areas or furnish and install approved access panels in non-accessible ceilings where boxes are installed.
- B. Support pull and junction boxes independent of conduit.

3.11 SYSTEM IDENTIFICATION CONDUIT COLORS – BY BRANCH:

- | | | |
|----|--------------------------------|----------------------------------|
| 1. | Emergency – Life Safety Branch | Yellow |
| 2. | Emergency – Critical Branch | Blue |
| 3. | Emergency – Equipment Branch | Orange |
| 4. | Fire Alarm | Red |
| 5. | Normal Power and Lighting | Silver (or unpainted galvanized) |
| 6. | Nurse Call | White |
| 7. | IT/Data | Purple |
| 8. | Low Voltage Data, Thermostat | Green |
| 9. | UPS | Black |

END OF SECTION 260533

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SECTION 260548 - VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes performance requirements for delegated design of vibration and seismic controls.

1.2 PERFORMANCE REQUIREMENTS

- A. Seismic-Restraint Loading: Refer to Structural Drawings for Seismic Design Category, Building Use Group, and Seismic design parameters.

1.3 SUBMITTALS

- A. Product Data: For all products provided.
- B. Delegated-Design Submittal: For vibration isolation and seismic-restraint calculations and details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Welding certificates.
- D. Qualification Data: For professional engineer.
- E. Field quality-control test reports.

1.4 QUALITY ASSURANCE

- A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.
- B. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- C. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproved by ICC-ES, or preapproved by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

PART 2 - PRODUCTS

- A. Products shall be selected by engineer providing delegated design services.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.
- B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Delegated Design Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.
- C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.2 VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

- A. Equipment Restraints:
 - 1. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds **0.125 inches**.
 - 2. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.
- B. Piping Restraints:
 - 1. Comply with requirements in MSS SP-127.
- C. Install cables so they do not bend across edges of adjacent equipment or building structure.

- D. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.
 - E. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
 - F. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
 - G. Drilled-in Anchors:
 - 1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
 - 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
 - 3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
 - 4. Set anchors to manufacturer's recommended torque, using a torque wrench.
 - 5. Install zinc-coated steel anchors for interior and stainless steel anchors for exterior applications.
- 3.3 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION
- A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Division 22 Section "Domestic Water Piping" for piping flexible connections.
- 3.4 FIELD QUALITY CONTROL
- A. Perform tests and inspections.
 - B. Tests and Inspections:
 - 1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
 - 2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
 - 3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
 - 4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
 - 5. Test to 90 percent of rated proof load of device.
 - 6. Measure isolator restraint clearance.
 - 7. Measure isolator deflection.
 - 8. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.
 - C. Remove and replace malfunctioning units and retest as specified above.
 - D. Prepare test and inspection reports, certified by Professional Engineer who provided Delegated Design.
- 3.5 ADJUSTING
- A. Adjust isolators after piping system is at operating weight.
 - B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

- C. Adjust active height of spring isolators.
 - D. Adjust restraints to permit free movement of equipment within normal mode of operation.
- END OF SECTION 260548

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Identification for conductors and communication and control cable.
 - 2. Warning labels and signs.
 - 3. Equipment identification labels.
 - 4. Ceiling identification labels.

1.2 SUBMITTALS

- A. Product Data: For each electrical identification product indicated.

1.3 QUALITY ASSURANCE

- A. Comply with ANSI A13.1.

1.4 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

PART 2 - PRODUCTS

2.1 CONDUCTOR AND COMMUNICATION- AND CONTROL-CABLE IDENTIFICATION MATERIALS

- A. Marker Tape: Vinyl or vinyl -cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

2.2 WARNING LABELS AND SIGNS

- A. Comply with NFPA 70 and 29 CFR 1910.145.
- B. Self-Adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.
- C. Baked-Enamel Warning Signs: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application. **1/4-inch** grommets in corners for mounting. Nominal size, **7 by 10 inches**.
- D. Metal-Backed, Butyrate Warning Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with **0.0396-inch** galvanized-steel backing; and with colors, legend, and size required for application. **1/4-inch** grommets in corners for mounting. Nominal size, **10 by 14 inches**.
- E. Fasteners for Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.
- F. Warning label and sign shall include, but are not limited to, the following legends:
 - 1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
 - 2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 mm)."

2.3 EQUIPMENT IDENTIFICATION LABELS

- A. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with color code as described below. Minimum letter height shall be **3/8 inch**.

2.4 CEILING IDENTIFICATION LABELS

- A. Permanent, self-adhesive $\frac{3}{4}$ " diameter colored labels

PART 3 - EXECUTION

3.1 APPLICATION

- A. Auxiliary Electrical Systems Conductor and Cable Identification: Use marker tape to identify field-installed alarm, control, signal, sound, intercommunications, voice, and data wiring connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and cable pull points. Identify by system and circuit designation.
 2. Use system of designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
 - B. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply baked-enamel warning signs or metal-backed, butyrate warning signs. Identify system voltage using color code as described below. Apply to exterior of door, cover, or other access.
 1. Equipment with Multiple Power or Control Sources: Apply to door or cover of equipment including, but not limited to, the following:
 - a. Power transfer switches.
 - b. Controls with external control power connections.
 2. Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.
 - C. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
 1. Labeling Instructions:
 - a. Indoor Equipment: Engraved, laminated acrylic or melamine label, drilled for screw attachment. Unless otherwise indicated, provide a single line of text with **1/2-inch**- high letters on **1-1/2-inch**- high label; where 2 lines of text are required, use labels **2 inches** high.
 - b. Outdoor Equipment: Engraved, laminated acrylic or melamine label, drilled for screw attachment.
 - c. Elevated Components: Increase sizes of labels and legend to those appropriate for viewing from the floor.
 2. Equipment to Be Labeled:
 - a. Panelboards, electrical cabinets, and enclosures.
 - b. Electrical switchgear and switchboards.
 - c. Transformers.
 - d. Motor-control centers.
 - e. Disconnect switches.
 - f. Enclosed circuit breakers.
 - g. Motor starters.
 - h. Push-button stations.
 - i. Power transfer equipment.
 - j. Contactors.
 - D. Ceiling identification labels
 1. Install ceiling identification labels on ceiling grid below junction boxes, switches, and other items that require adjustment.
 2. Install prior to installation of ceiling tile.
- 3.2 INSTALLATION
- A. Verify identity of each item before installing identification products.
 - B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
 - C. Apply identification devices to surfaces that require finish after completing finish work.
 - D. Attach nonadhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.

- E. Color-Coding for Phase and Voltage Level Identification, 600 V and Less: Use the colors listed below for ungrounded service, feeder, and branch-circuit conductors.
 - 1. Color shall be factory applied.
 - 2. Colors for 208/120-V Circuits:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - c. Phase C: Blue.
 - d. Neutral: White
 - 3. Colors for 480/277-V Circuits:
 - a. Phase A: Brown.
 - b. Phase B: Orange.
 - c. Phase C: Yellow.
 - d. Neutral: Gray
 - 4. Isolated Circuits:
 - a. Hot: Orange
 - b. Neutra: Brown
 - F. Color-Coding for Equipment Identification: MATCH FACILITY STANDARD. When no facility standard exists, use the colors listed below for equipment.
 - 1. Normal Branch Power: Green label with white lettering
 - 2. Life Safety Branch Power: Yellow label with white lettering
 - 3. Critical Branch Power: Blue label with white lettering
 - 4. Equipment Branch Power: Red label with white lettering.
 - G. All outlet boxes, junction boxes and pull boxes shall have their covers and exterior visible surfaces painted with colors to match the surface color scheme outlined above. This includes covers above lift-out and other type accessible ceilings.
 - H. All J-box covers to be identified with circuit number.
- END OF SECTION 260553

SECTION 260913 - ELECTRICAL POWER MONITORING AND CONTROL

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes PC-based workstation(s) and software for monitoring[**and control**] of electrical power system.
- B. See Division 26 Section "Electricity Metering" for equipment to meter electricity consumption and demand for tenant submetering.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Attach copies of approved Product Data submittals for products (such as switchboards and switchgear) that describe power monitoring and control features to illustrate coordination among related equipment and power monitoring and control.
- B. Shop Drawings: For power monitoring and control equipment. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Block Diagram: Show interconnections between components specified in this Section and devices furnished with power distribution system components.
 - 2. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
- C. Software and Firmware Operational Documentation:
 - 1. Software operating and upgrade manuals.
 - 2. Software Backup: On a magnetic media or compact disc, complete with Owner-selected options.
 - 3. Device address list and the set point of each device and operator option, as set in applications software.
- D. Software Upgrade Kit: For Owner to use in modifying software to suit future power system revisions or power monitoring and control revisions.
- E. Software licenses and upgrades required by and installed for operating and programming digital and analog devices.
- F. Field quality-control test reports.
- G. Operation and Maintenance Data: For power monitoring and control units, to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
 - 1. Operating and applications software documentation.
 - 2. Software licenses.
 - 3. Hard copies of manufacturer's specification sheets, operating specifications, design guides, user's guides for software and hardware, and PDF files on CD-ROM of the hard-copy submittal.
- H. Other Informational Submittals:
 - 1. System installation and setup guides, with data forms to plan and record options and setup decisions.

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.

1.4 SOFTWARE SERVICE AGREEMENT

- A. Technical Support: Beginning with Substantial Completion, provide software support for **[two]** years.
- B. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within **[two]** years from date of

Substantial Completion. Upgrading software shall include the operating systems.

Upgrade shall include new or revised licenses for use of software.

1. Provide 30-day notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- 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:
- C. Basis-of-Design Product: Subject to compliance with requirements, provide **[the product indicated on Drawings]** or a comparable product by one of the following:
 1. Schneider Electric.

2.2 FUNCTIONAL DESCRIPTION

- A. Instrumentation and Recording Devices: Monitor and record load profiles and chart energy consumption patterns.
 1. Calculate and Record the Following:
 - a. Load factor.
 - b. Peak demand periods.
 - c. Consumption correlated with facility activities.
- B. Software: Calculate allocation of utility costs.
 1. Automatically Import Energy Usage Records to Allocate Energy Costs for the Following:
 - a. At least **[15]** departments.
 - b. At least **[30]** tenants.
 - c. At least **[five]** processes.
 - d. At least **[five]** buildings.
 2. Verify utility bills **[and analyze alternate energy rates]**.
- C. Power Quality Monitoring: Identify power system anomalies and measure, display, and record trends and alarms of the following power quality parameters:
 1. Voltage regulation and unbalance.
 2. Continuous three-phase rms voltage.
 3. Periodic max./min./avg. samples.
 4. Harmonics.
 5. Voltage excursions.

2.3 SYSTEM REQUIREMENTS

- A. Surge Protection: For external wiring of each conductor entry connection to components to protect components from voltage surges originating external to equipment housing and entering through power, communication, signal, control, or sensing leads.
 1. Minimum Protection for Power Lines 120 V and More: Auxiliary panel suppressors complying with requirements in Division 26 Section "Transient-Voltage Suppression for Low-Voltage Electrical Power Circuits."

2.4 OPERATING SYSTEM

- A. Software: Configured to run on a portable laptop computer, a single PC, or a palm computer, with capability for accessing a single meter at a time.

2.5 APPLICATIONS SOFTWARE

- A. Basic Requirements:
 1. Fully compatible with and based on the approved operating system.
 2. Password-protected operator login and access.
 3. Password-protected setup functions.
 4. Context sensitive on-line help.

5. Capability of creating, deleting, and copying files; and automatically maintaining a directory of all files, including size and location of each sequential and random-ordered record.
 6. Automatic and encrypted backups for database and history; automatically stored at **[central control PC]** and encrypted with a nine-character alphanumeric password, which must be used to restore or read data contained in backup.
 7. Operator audit trail for recording and reporting all changes made to user-defined system options.
- B. Data Formats:
1. User-programmable export and import of data to and from commonly used **[Microsoft Windows]** spreadsheet, database, billing, and other applications; using dynamic data exchange technology.
 2. Option to convert reports and graphics to HTML format.
- C. Metered Data: Display metered values in real-time.
- D. Remote Control:
1. Display circuit-breaker status and allow breaker control.
 2. User defined with load-shedding automatically initiated and executed schemes responding to programmed time schedules, set points of metered demands, utility contracted load shedding, or combinations of these.
- E. Waveform Data: Display and record waveforms on demand or automatically on an alarm or programmed event; include the graphic displays of the following, based on user-specified criteria:
1. Phase voltages, phase currents, and residual current.
 2. Waveforms ranging in length from **[2]** cycles to **[5]** minutes.
 3. Disturbance and steady-state waveforms up to 512 points per cycle.
 4. Calculated waveform on a minimum of four cycles of data of the following:
 - a. THD.
 - b. rms magnitudes.
 - c. Peak values.
 - d. Crest factors.
 - e. Magnitude of individual harmonics.
- F. Data Sharing: Allow export of recorded displays and tabular data to third-party applications software.
- G. Tenant or Activity Billing Software:
1. Automatically compute and prepare **[activity demand and energy-use statements]** based on metering of energy use and peak demand integrated over user-defined interval.
 2. Intervals shall be same as used by electric utilities, including current vendor.
 3. Import metered data from saved records that were generated by metering and monitoring software.
 4. Maintain separate directory for each tenant's historical billing information.
 5. Prepare summary reports in user-defined formats and time intervals.
- H. Reporting: User commands initiate the reporting of a list of current alarm, supervisory, and trouble conditions in system or a log of past events.
1. Print a record of user-defined alarm, supervisory, and trouble events on workstation printer.
 2. Sort and report by device name and by function.
 3. Report type of signal (alarm, supervisory, or trouble), description, date, and time of occurrence.
 4. Differentiate alarm signals from other indications.
 5. When system is reset, report reset event with same information concerning device, location, date, and time.

2.6 COMMUNICATION COMPONENTS AND NETWORKS

- A. Transient Voltage Surge Suppression and Electromagnetic-Interference Immunity:
Include in solid-state equipment. Comply with IEEE C37.90.

2.7 POWER MONITORS

- A. Separately mounted, permanently installed instrument for power monitoring and control.
1. Enclosure: NEMA 250, Type [1].
- B. Environmental Conditions: System components shall be capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:
1. Indoor installation in [non-air-conditioned] spaces that have environmental controls to maintain ambient conditions of [0 to 122 deg F] dry bulb and 20 to 90 percent relative humidity, noncondensing.
- C. rms Real-Time Measurements:
1. Current: Each phase, neutral, average of three phases, percent unbalance.
2. Voltage: Line-to-line each phase, line-to-line average of three phases, line-to-neutral each phase, line-to-neutral average of three phases, line-to-neutral percent unbalance.
3. Power: Per phase and three-phase total.
4. Reactive Power: Per phase and three-phase total.
5. Power Factor: Per phase and three-phase total.
6. Frequency.
7. THD: Current and voltage.
8. Accumulated Energy: Real kWh, reactive kVARh, apparent kVAh (signed/absolute).
9. Incremental Energy: Real kWh, reactive kVARh, apparent kVAh (signed/absolute).
10. Conditional Energy: Real kWh, reactive kVARh, apparent kVAh (signed/absolute).
- D. Demand Current Calculations, per Phase, Three-Phase Average and Neutral:
1. Present.
2. Running average.
3. Last completed interval.
4. Peak.
- E. Demand Real Power Calculations, Three-Phase Total:
1. Present.
2. Running average.
3. Last completed interval.
4. Predicted.
5. Peak.
6. Coincident with peak kVA demand.
7. Coincident with kVAR demand.
- F. Demand Reactive Power Calculations, Three-Phase Total:
1. Present.
2. Running average.
3. Last completed interval.
4. Predicted.
5. Peak.
6. Coincident with peak kVA demand.
7. Coincident with kVAR demand.
- G. Average Power Factor Calculations, Demand Coincident, Three-Phase Total:
1. Last completed interval.
2. Coincident with kW peak.
3. Coincident with kVAR peak.
4. Coincident with kVA peak.

- H. Power Demand Calculations: According to one of the following calculation methods, selectable by the user:
 - 1. Thermal Demand: Sliding window updated every second for the present demand and at end of the interval for the last interval. Adjustable window that can be set in 1-minute intervals, from 1 to 60 minutes.
 - 2. Block Interval with Optional Subintervals: Adjustable for 1-minute intervals, from 1 to 60 minutes. User-defined parameters for the following block intervals:
 - a. Sliding block that calculates demand every second, with intervals less than 15 minutes, and every 15 seconds with an interval between 15 and 60 minutes.
 - b. Fixed block that calculates demand at end of the interval.
 - c. Rolling block subinterval that calculates demand at end of each subinterval and displays it at end of the interval.
 - 3. Demand Calculation Initiated by a Synchronization Signal:
 - a. Signal is a pulse from an external source. Demand period begins with every pulse. Calculation shall be configurable as either a block or rolling block calculation.
 - b. Signal is a communication signal. Calculation shall be configurable as either a block or rolling block calculation.
- I. Sampling:
 - 1. Current and voltage shall be digitally sampled at a rate high enough to provide accuracy to 63rd harmonic of 60-Hz fundamental.
 - 2. Power monitor shall provide continuous sampling at a rate of [128] samples per cycle on all voltage and current channels in the meter.
- J. Minimum and Maximum Values: Record monthly minimum and maximum values, including date and time of record. For three-phase measurements, identify phase of recorded value. Record the following parameters:
 - 1. Line-to-line voltage.
 - 2. Line-to-neutral voltage.
 - 3. Current per phase.
 - 4. Line-to-line voltage unbalance.
 - 5. Line-to-neutral voltage unbalance.
 - 6. Power factor.
 - 7. Displacement power factor.
 - 8. Total power.
 - 9. Total reactive power.
 - 10. THD voltage L-L.
 - 11. THD voltage L-N.
 - 12. THD current.
 - 13. Frequency.
- K. Harmonic Calculation: Display and record the following:
 - 1. Harmonic magnitudes and angles for each phase voltage and current through 31st harmonic. Current and voltage information for all phases shall be obtained simultaneously from same cycle.
 - 2. Harmonic magnitude reported as a percentage of the fundamental or as a percentage of rms values, as selected by user.
- L. Current and Voltage Ratings:
 - 1. Designed for use with current inputs from standard instrument current transformers with 5-A secondary and shall have a metering range of 0-10 A.
 - 2. Withstand ratings shall be not less than 15 A, continuous; 50 A, lasting over 10 seconds, no more frequently than once per hour; 500 A, lasting 1 second, no more frequently than once per hour.

3. Designed for use with voltage inputs from standard instrument potential transformers with a 120-V secondary.
- M. Accuracy:
 1. Comply with ANSI C12.20, Class 0.5; and IEC 60687, Class 0.5 for revenue meters.
 2. Accuracy from Light to Full Rating:
 - a. Power: Accurate to 0.25 percent of reading, plus 0.025 percent of full scale.
 - b. Voltage and Current: Accurate to 0.075 percent of reading, plus 0.025 percent of full scale.
 - c. Power Factor: Plus or minus 0.002, from 0.5 leading to 0.5 lagging.
 - d. Frequency: Plus or minus 0.01 Hz at 45 to 67 Hz.
- N. Waveform Capture:
 1. Capture and store steady-state waveforms of voltage and current channels; initiated manually. Each capture shall be for 3 cycles, 128 data points for each cycle, allowing resolution of harmonics to 31st harmonic of basic 60 Hz.
 2. Store captured waveforms in internal nonvolatile memory; available for PC display, archiving, and analysis.
- O. Input: **[One]** digital input signal(s).
 1. Normal mode for on/off signal.
 2. Demand interval synchronization pulse, accepting a demand synchronization pulse from a utility demand meter.
 3. Conditional energy signal to control conditional energy accumulation.
- P. Outputs:
 1. Operated either by user command sent via communication link, or set to operate in response to user-defined alarm or event.
 2. Closed in either a momentary or latched mode as defined by user.
 3. Each output relay used in a momentary contact mode shall have an independent timer that can be set by user.
 4. One digital KY pulse to a user-definable increment of energy measurement. Output ratings shall be up to 120-V ac, 300-V dc, 50 mA, and provide 3500-V rms isolation.
 5. **[One]** relay output module(s), providing a load voltage range from 20- to 240-V ac or from 20- to 30-V dc, supporting a load current of 2 A.
 6. Output Relay Control:
 - a. Relay outputs shall operate either by user command sent via communication link or in response to user-defined alarm or event.
 - b. Normally open and normally closed contacts, field configured to operate as follows:
 - 1) Normal contact closure where contacts change state for as long as signal exists.
 - 2) Latched mode when contacts change state on receipts of a pickup signal; changed state is held until a dropout signal is received.
 - 3) Timed mode when contacts change state on receipt of a pickup signal; changed state is held for a preprogrammed duration.
 - 4) End of power demand interval when relay operates as synchronization pulse for other devices.
 - 5) Energy Pulse Output: Relay pulses quantities used for absolute kWh, absolute kVARh, kVAh, kWh In, kVARh In, kWh Out, and kVARh Out.
 - 6) Output controlled by multiple alarms using Boolean-type logic.
- Q. Onboard Data Logging:
 1. Store logged data, alarms, events, and waveforms in **[80]** KB of onboard nonvolatile memory.
 2. Stored Data:

- a. Billing Log: User configurable; data shall be recorded every 15 minutes, identified by month, day, and 15-minute interval. Accumulate 24 months of monthly data, 32 days of daily data, and between 2 to 52 days of 15-minute interval data, depending on number of quantities selected.
 - b. Custom Data Logs: **[One]** user-defined log(s) holding up to 96 parameters. Date and time stamp each entry to the second and include the following user definitions:
 - 1) Schedule interval.
 - 2) Event definition.
 - 3) Configured as "fill-and-hold" or "circular, first-in first-out."
 - c. Alarm Log: Include time, date, event information, and coincident information for each defined alarm or event.
 - d. Waveform Log: Store captured waveforms configured as "fill-and-hold" or "circular, first-in first-out."
3. Default values for all logs shall be initially set at factory, with logging to begin on device power up.
- R. Alarms:
- 1. User Options:
 - a. Define pickup, dropout, and delay.
 - b. Assign one of **[four]** severity levels to make it easier for user to respond to the most important events first.
 - c. Allow for combining up to **[four]** alarms using Boolean-type logic statements for outputting a single alarm.
 - 2. Alarm Events:
 - a. Over/undercurrent.
 - b. Over/undervoltage.
 - c. Current imbalance.
 - d. Phase loss, current.
 - e. Phase loss, voltage.
 - f. Voltage imbalance.
 - g. Over kW demand.
 - h. Phase reversal.
 - i. Digital input off/on.
 - j. End of incremental energy interval.
 - k. End of demand interval.
- S. Control Power: 90- to 457-V ac or 100- to 300-V dc.
- T. Communications:
- 1. Power monitor shall be permanently connected to communicate via Modbus TCP via a 100 Base-T Ethernet.
 - 2. Local plug-in connections shall be for RS-232 and 100 Base-T Ethernet.
- U. Display Monitor:
- 1. Backlighted LCD to display metered data with **[touch-screen]** selecting device.
 - 2. Touch-screen display shall be a minimum 12-inch diagonal, resolution of 800 by 600 RGB pixels, 256 colors; NEMA 250, Type 1 display enclosure.
 - 3. Display **[four]** values on one screen at same time.
 - a. Current, per phase rms, three-phase average[**and neutral**].
 - b. Voltage, phase to phase, phase to neutral, and three-phase averages of phase to phase and phase to neutral.
 - c. Real power, per phase and three-phase total.
 - d. Reactive power, per phase and three-phase total.
 - e. Apparent power, per phase and three-phase total.
 - f. Power factor, per phase and three-phase total.

- g. Frequency.
 - h. Demand current, per phase and three-phase average.
 - i. Demand real power, three-phase total.
 - j. Accumulated energy (MWh and MVARh).
 - k. THD, current and voltage, per phase.
 - 4. Reset: Allow reset of the following parameters at the display:
 - a. Peak demand current.
 - b. Peak demand power (kW) and peak demand apparent power (kVA).
 - c. Energy (MWh) and reactive energy (MVARh).
- 2.8 LOW-VOLTAGE WIRING
 - A. Low-Voltage Control Cable: Multiple conductor, color-coded, No. 20 AWG copper, minimum.
 - 1. Sheath: PVC; except in plenum-type spaces, use sheath listed for plenums.
 - 2. Ordinary Switching Circuits: Three conductors, unless otherwise indicated.
 - 3. Switching Circuits with Pilot Lights or Locator Feature: Five conductors, unless otherwise indicated.

PART 3 - EXECUTION

3.1 CABLING

- A. Comply with NECA 1.
- B. Install cables and wiring according to requirements in Division 27 Section "Communications Horizontal Cabling."
- C. Wiring Method: Install wiring in raceway and cable tray except within consoles, cabinets, desks, and counters. Conceal raceway and wiring except in unfinished spaces.
- D. Wiring Method: Install wiring in raceway and cable tray except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Use NRTL-listed plenum cable in environmental air spaces, including plenum ceilings. Conceal raceway and cables except in unfinished spaces.
- E. Identify components and power and control wiring according to Division 26 Section "Identification for Electrical Systems."
- F. Label each power monitoring and control module with a unique designation.
- G. Grounding: Comply with IEEE 1100, "Power and Grounding Sensitive Electronic Equipment."

3.2 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Tests and Inspections:
 - 1. Electrical Tests: Use caution when testing devices containing solid-state components.
 - 2. Continuity tests of circuits.
 - 3. Operational Tests: Set and operate controls at workstation and at monitored and controlled devices to demonstrate their functions and capabilities. Use a methodical sequence that cues and reproduces actual operating functions as recommended by manufacturer. Submit sequences for approval. Note response to each test command and operation. Note time intervals between initiation of alarm conditions and registration of alarms at central-processing workstation.
 - a. Coordinate testing required by this Section with that required by Sections specifying equipment being monitored and controlled.
 - b. Test LANs according to requirements in Division 27 Section "Communications Horizontal Cabling."

- c. System components with battery backup shall be operated on battery power for a period of not less than 10 percent of calculated battery operating time.
 - d. Verify accuracy of graphic screens and icons.
 - e. Metering Test: Load feeders, measure loads on feeder conductor with an rms reading clamp-on ammeter, and simultaneously read indicated current on the same phase at central-processing workstation. Record and compare values measured at the two locations. Resolve discrepancies greater than 5 percent and record resolution method and results.
 - f. Record metered values, control settings, operations, cues, time intervals, and functional observations and submit test reports printed by workstation printer.
 - C. Correct deficiencies, make necessary adjustments, and retest. Verify that specified requirements are met.
 - D. Test Labeling: After satisfactory completion of tests and inspections, apply a label to tested components indicating test results, date, and responsible agency and representative.
 - E. Reports: Written reports of tests and observations. Record defective materials and workmanship and unsatisfactory test results. Record repairs and adjustments.
 - F. Remove and replace malfunctioning devices and circuits and retest as specified above.
- 3.3 DEMONSTRATION
- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain systems. Refer to Division 01 Section "Demonstration and Training."
 - 1. Train Owner's management and maintenance personnel in interpreting and using monitoring displays and in configuring and using software and reports. Include troubleshooting, servicing, adjusting, and maintaining equipment. Provide a minimum of [12] hours' training.
 - 2. Training Aid: Use approved final versions of software and maintenance manuals as training aids.

END OF SECTION 260913

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SECTION 260923 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following lighting control devices:
 - 1. Outdoor photoelectric switches.
 - 2. Indoor occupancy sensors.
 - 3. Outdoor motion sensors.
- B. See Division 26 Section "Wiring Devices" for wall-box dimmers, wall-switch occupancy sensors, and manual light switches.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control test reports.
- C. Operation and maintenance data.

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.

PART 2 - PRODUCTS

2.1 OUTDOOR PHOTOELECTRIC SWITCHES

- A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - 1. Area Lighting Research, Inc.; Tyco Electronics.
 - 2. Cooper Controls
 - 3. Lithonia Lighting; Acuity Lighting Group, Inc.
 - 4. Square D; Schneider Electric.
 - 5. Watt Stopper (The).
- B. Description: Solid state, with **[SPST]** dry contacts rated for **[1800-VA tungsten or 1000-VA inductive]**, to operate connected relay, contactor coils, or microprocessor input; complying with UL 773A.
 - 1. Light-Level Monitoring Range: **1.5 to 10 fc**, with an adjustment for turn-on and turn-off levels within that range, and a directional lens in front of photocell to prevent fixed light sources from causing turn-off.
 - 2. Time Delay: 15-second minimum, to prevent false operation.
 - 3. Surge Protection: Metal-oxide varistor, complying with IEEE C62.41.1, IEEE C62.41.2, and IEEE 62.45 for Category A1 locations.
 - 4. Mounting: Twist lock complying with IEEE C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the north sky exposure.
- C. Description: Solid state, with **[SPST]** dry contacts rated for 1800 VA to operate connected load, relay, or contactor coils; complying with UL 773.
 - 1. Light-Level Monitoring Range: **1.5 to 10 fc**, with an adjustment for turn-on and turn-off levels within that range.
 - 2. Time Delay: 30-second minimum, to prevent false operation.
 - 3. Lightning Arrester: Air-gap type.
 - 4. Mounting: Twist lock complying with IEEE C136.10, with base.

2.2 INDOOR OCCUPANCY SENSORS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - 1. Hubbell Lighting.
 - 2. Leviton Mfg. Company Inc.
 - 3. Lithonia Lighting; Acuity Lighting Group, Inc.
 - 4. Sensor Switch, Inc.

- B. General Description: Wall- or ceiling-mounting, solid-state units with a separate relay unit.
 - 1. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
 - 2. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
 - 3. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
 - 4. Mounting:
 - a. Sensor: Suitable for mounting in any position on a standard outlet box.
 - b. Relay: Externally mounted through a **1/2-inch** knockout in a standard electrical enclosure.
 - c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
 - 5. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
 - 6. Bypass Switch: Override the on function in case of sensor failure.
 - 7. Automatic Light-Level Sensor: Adjustable from **2 to 200 fc**; keep lighting off when selected lighting level is present.
 - C. PIR Type: Ceiling mounting; detect occupancy by sensing a combination of heat and movement in area of coverage.
 - 1. Detector Sensitivity: Detect occurrences of **6-inch-** minimum movement of any portion of a human body that presents a target of not less than **36 sq. in..**
 - 2. Detection Coverage (Room): Detect occupancy anywhere in a circular area of **1000 sq. ft.** when mounted on a **96-inch-** high ceiling.
 - 3. Detection Coverage (Corridor): Detect occupancy within **90 feet** when mounted on a **10-foot-** high ceiling.
- 2.3 OUTDOOR MOTION SENSORS (PIR)
- A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - 1. Bryant Electric; a Hubbell Company.
 - 2. Hubbell Lighting.
 - 3. Lithonia Lighting; Acuity Lighting Group, Inc.
 - 4. Paragon Electric Co.; Invensys Climate Controls.
 - 5. RAB Lighting, Inc.
 - 6. TORK.
 - 7. Watt Stopper (The).
 - B. Performance Requirements: Suitable for operation in ambient temperatures ranging from **minus 40 to plus 130 deg F**, rated as raintight according to UL 773A.
 - 1. Operation: Turn lights on when sensing infrared energy changes between background and moving body in area of coverage; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
 - 2. Mounting:
 - a. Sensor: Suitable for mounting in any position on a standard outdoor junction box.
 - b. Relay: Internally mounted in a standard weatherproof electrical enclosure.
 - c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
 - 3. Bypass Switch: Override the on function in case of sensor failure.
 - 4. Automatic Light-Level Sensor: Adjustable from **1 to 20 fc**; keep lighting off during daylight hours.

- C. Detector Sensitivity: Detect occurrences of **6-inch-** minimum movement of any portion of a human body that presents a target of not less than **36 sq. in..**
 - D. Detection Coverage: **[Up to 35 feet, with a field of view of 180 degrees].**
 - E. Lighting Fixture Mounted Sensor: Suitable for switching 300 W of tungsten load at 120- or 277-V ac.
 - F. Individually Mounted Sensor: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
 - 1. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
 - 2. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
- 2.4 CONDUCTORS AND CABLES
- A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
 - B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. **[18]** AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
 - C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. **[14]** AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 SENSOR INSTALLATION

- A. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.
- B. When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to two visits to Project during other than normal occupancy hours for this purpose.

3.2 CONTACTOR INSTALLATION

- A. Mount electrically held lighting contactors with elastomeric isolator pads, to eliminate structure-borne vibration, unless contactors are installed in an enclosure with factory-installed vibration isolators.

3.3 WIRING INSTALLATION

- A. Wiring Method: Comply with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size shall be **1/2 inch.**
- B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
- C. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.
- D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.4 IDENTIFICATION

- A. Identify components and power and control wiring according to Division 26 Section "Identification for Electrical Systems."
 - 1. Identify controlled circuits in lighting contactors.
 - 2. Identify circuits or luminaries controlled by photoelectric and occupancy sensors at each sensor.
- B. Label time switches and contactors with a unique designation.

3.5 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:

1. After installing time switches and sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.
 2. Operational Test: Verify operation of each lighting control device, and adjust time delays.
- B. Lighting control devices that fail tests and inspections are defective work.
- END OF SECTION 260923

SECTION 262200 - LOW-VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following types of dry-type transformers rated 600 V and less, with capacities up to 1000 kVA:
 - 1. Distribution transformers.
 - 2. Buck-boost transformers.

1.2 SUBMITTALS

- A. Product Data: For each product indicated.
- B. Shop Drawings: Indicate dimensions and weights.
 - 1. Wiring Diagrams: Power, signal, and control wiring.
- C. Manufacturer Seismic Qualification Certification: Submit certification that transformers, accessories, and components will withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
- D. Field quality-control test reports.
- E. Operation and maintenance data.

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 IEEE C57.12.91, "Test Code for Dry-Type Distribution and Power Transformers."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design Product: As shown on Drawings.
- B. Comparable products by one of the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Products.
 - 2. General Electric Company.
 - 3. Square D; Schneider Electric.

2.2 GENERAL TRANSFORMER REQUIREMENTS

- A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.
- B. Cores: Grain-oriented, non-aging silicon steel.
- C. Coils: Continuous windings without splices except for taps.
 - 1. Internal Coil Connections: Brazed or pressure type.
 - 2. Coil Material: **[Copper]**.

2.3 DISTRIBUTION TRANSFORMERS

- A. Comply with NEMA ST 20, and list and label as complying with UL 1561.
- B. Provide transformers that are constructed to withstand seismic forces specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
- C. Cores: One leg per phase.
- D. Enclosure: [Ventilated], NEMA 250, Type 2.
 - 1. Core and coil shall be encapsulated within resin compound, sealing out moisture and air.
- E. Enclosure: [Ventilated], NEMA 250,.
 - 1. Core and coil shall be encapsulated within resin compound, sealing out moisture and air.
- F. Transformer Enclosure Finish: Comply with NEMA 250.
 - 1. Finish Color: [Gray].
- G. Taps for Transformers Smaller Than 3 kVA: **[One 5 percent tap above normal full capacity]**.
- H. Taps for Transformers 7.5 to 24 kVA: [One 5 percent tap above and one 5 percent tap below normal full capacity].
- I. Taps for Transformers 25 kVA and Larger: [Two 2.5 percent taps above and two 2.5 percent taps below normal full capacity].
- J. Insulation Class: 220 deg C, UL-component-recognized insulation system with a maximum of **[115]** deg C rise above 40 deg C ambient temperature.
- K. Energy Efficiency for Transformers Rated 15 kVA and Larger:
 - 1. Complying with NEMA TP 1, Class 1 efficiency levels.
 - 2. Tested according to NEMA TP 2.
- L. K-Factor Rating: Transformers indicated to be K-factor rated shall comply with UL 1561 requirements for nonsinusoidal load current-handling capability to the degree defined by designated K-factor.
 - 1. Unit shall not overheat when carrying full-load current with harmonic distortion corresponding to designated K-factor.
 - 2. Indicate value of K-factor on transformer nameplate.

- M. Electrostatic Shielding: Each winding shall have an independent, single, full-width copper electrostatic shield arranged to minimize interwinding capacitance.
- N. Wall Brackets: Manufacturer's standard brackets.

2.4 BUCK-BOOST TRANSFORMERS

- A. Description: Self-cooled, two-winding dry type, rated for continuous duty and with wiring terminals suitable for connection as autotransformer. Transformers shall comply with NEMA ST 1 and shall be listed and labeled as complying with UL 506 or UL 1561.
- B. Enclosure: Ventilated, NEMA 250, Type 2.
 - 1. Finish Color: [Gray].

2.5 IDENTIFICATION DEVICES

- A. Nameplates: Engraved, laminated-plastic or metal nameplate. Nameplates are specified in Division 26 Section "Identification for Electrical Systems."

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install wall-mounting transformers level and plumb with wall brackets fabricated by transformer manufacturer.
 - 1. Brace wall-mounting transformers as specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
- B. Construct concrete bases and anchor floor-mounting transformers according to manufacturer's written instructions, seismic codes applicable to Project, and requirements in Division 26 Section "Hangers and Supports for Electrical Systems."

3.2 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 2. Infrared Scanning: Two months after Substantial Completion, perform an infrared scan of transformer connections.
 - a. Use an infrared-scanning device designed to measure temperature or detect significant deviations from normal values. Provide documentation of device calibration.
 - b. Perform 2 follow-up infrared scans of transformers, one at 4 months and the other at 11 months after Substantial Completion.

- c. Prepare a certified report identifying transformer checked and describing results of scanning. Include notation of deficiencies detected, remedial action taken, and scanning observations after remedial action.

3.3 ADJUSTING

- A. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 10 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.
- B. Connect buck-boost transformers to provide nameplate voltage of equipment being served, plus or minus 5 percent, at secondary terminals.
- C. Output Settings Report: Prepare a written report recording output voltages and tap settings.

END OF SECTION 262200

SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes distribution panelboards and lighting and appliance branch-circuit panelboards.

1.2 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Panelboards shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
 - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For each panelboard and related equipment.
 - 1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
 - 2. Detail enclosure types and details for types other than NEMA 250, Type 1.
 - 3. Detail bus configuration, current, and voltage ratings.
 - 4. Short-circuit current rating of panelboards and overcurrent protective devices.
 - 5. Include evidence of NRTL listing for series rating of installed devices.
 - 6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 - 7. Include wiring diagrams for power, signal, and control wiring.
 - 8. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards.
- C. Seismic Qualification Certificates: Submit certification that panelboards, overcurrent protective devices, accessories, and components will withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
- D. Field quality-control reports.
- E. Panelboard schedules for installation in panelboards.
- F. Operation and maintenance data.

1.4 QUALITY ASSURANCE

- 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. Comply with NEMA PB 1.
- C. Comply with NFPA 70.

1.5 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

- A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
- B. Enclosures: Flush- and surface-mounted cabinets.
 - 1. Rated for environmental conditions at installed location.
 - a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
 - b. Outdoor Locations: NEMA 250, Type 3R.
 - c. Kitchen Areas: NEMA 250, Type 4X.
 - d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
 - 2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.

3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
 4. Directory Card: Inside panelboard door, mounted in transparent card holder.
 - C. Incoming Mains Location: Top and bottom, as shown on Drawings.
 - D. Phase, Neutral, and Ground Buses: Hard-drawn copper, 98 percent conductivity.
 - E. Conductor Connectors: Suitable for use with conductor material and sizes.
 1. Material: **[Hard-drawn copper, 98 percent conductivity]**.
 2. Main and Neutral Lugs: **[Mechanical]** type.
 3. Ground Lugs and Bus Configured Terminators: **[Mechanical]** type.
 4. Feed-Through Lugs: **[Mechanical]** type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
 5. Subfeed (Double) Lugs: **[Mechanical]** type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
 - F. Service Equipment Label: NRTL labeled for use as service equipment for all panelboards.
 - G. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
 - H. Panelboard Short-Circuit Current Rating: Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by an NRTL. Include size and type of allowable upstream and branch devices, and listed and labeled for series-connected short-circuit rating by an NRTL.
 - I. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.
 - J. Provide surge protection devices on all emergency panelboards per NEC 700.8. Refer to electrical specification section: 264313 Transient-Voltage Surge Suppression for details.
- 2.2 DISTRIBUTION PANELBOARDS
- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 1. Square D; a brand of Schneider Electric.
 - B. Panelboards: NEMA PB 1, power and feeder distribution type.
 - C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
 - D. Mains: Circuit breaker, Fused switch, or Lugs only, as indicated on drawings.
 - E. Branch Overcurrent Protective Devices: For Circuit-Breaker Frame Sizes 125 A and Smaller: **[Bolt-on]** circuit breakers.
 - F. Branch Overcurrent Protective Devices: 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.
 - G. Branch Overcurrent Protective Devices: Fused switches.
- 2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS
- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 1. Square D; a brand of Schneider Electric.
 - B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
 - C. Mains: Circuit breaker or lugs only.
 - D. Branch Overcurrent Protective Devices: **[Bolt-on]** circuit breakers, replaceable without disturbing adjacent units.
 - E. Contactors in Main Bus: NEMA ICS 2, Class A, **[electrically]** held, general-purpose controller, with same short-circuit interrupting rating as panelboard.
 1. External Control-Power Source: **[120-V branch circuit]**.
 - F. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.
 - G. Column-Type Panelboards: Narrow gutter extension, with cover, to overhead junction box equipped with ground and neutral terminal buses.

- 2.1 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES. (SERVICE ENTRANCE MAIN BREAKER TO BE GFI PROTECTED PER NEC 230.95)
- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - 1. Square D; a brand of Schneider Electric.
 - B. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, 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 circuit breakers with rms sensing; field-replaceable rating plug or field-replaceable electronic trip; and 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. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
 - 6. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
 - 7. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
 - 8. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
 - a. Standard frame sizes, trip ratings, and number of poles.
 - b. Lugs: **[Mechanical]** style, suitable for number, size, trip ratings, and conductor materials.
 - c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
 - d. Ground-Fault Protection: **[Integrally mounted]** relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
 - e. Communication Capability: **[Circuit-breaker-mounted]** communication module with functions and features compatible with power monitoring and control system specified in Division 26 Section "Electrical Power Monitoring and Control."
 - f. Shunt Trip: **[120]** -V trip coil energized from separate circuit, set to trip at **[55]** percent of rated voltage.
 - g. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in **[on or off]** position.
 - h. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.
 - C. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.
 - 1. Fuses, and Spare-Fuse Cabinet: Comply with requirements specified in Division 26 Section "Fuses."

2.2 ACCESSORY COMPONENTS AND FEATURES

- A. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Receive, inspect, handle, store and install panelboards and accessories according to **[NECA 407] [NEMA PB 1.1]**.
- B. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
- C. Mount top of trim **90 inches** above finished floor unless otherwise indicated.
- D. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
- E. Install overcurrent protective devices and controllers not already factory installed.
 - 1. Set field-adjustable, circuit-breaker trip ranges.
- F. Install filler plates in unused spaces.
- G. Stub four **1-inch** empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four **1-inch (27-GRC)** empty conduits into raised floor space or below slab not on grade.
- H. Arrange conductors in gutters into groups and bundle and wrap with wire ties.
- I. Comply with NECA 1.

3.2 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Division 26 Section "Identification for Electrical Systems."
- B. Create a directory to indicate installed circuit loads and incorporating Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
- C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."
- D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- C. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. 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.
- D. Panelboards will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.4 STUDIES

- A. Electrical Contractor to provide a complete short circuit and selective coordination study from the service entrance to all end devices. The study shall be provided by the switchgear manufacturer and utilize time current curves provided by manufacturer for the specific project. The study shall be made available for engineer's review and included with shop drawings. **Study must be reviewed and approved prior to submitting panelboards.**
- B. The selective coordination study shall meet the requirements described by NEC Articles 700.32, 701.27, 708.54, and 620.62.
- C. The minimum NEC requirement for the selective coordination study is applicable to the systems described in NEC Articles 700.32, 701.27, 708.54, and 620.62, and as indirectly referenced for essential electrical systems in Article 517.

END OF SECTION 262416

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SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Receptacles, receptacles with integral GFCI, and associated device plates.
 - 2. Wall-box motion sensors.
 - 3. Snap switches and wall-box dimmers.
 - 4. Solid-state fan speed controls.
 - 5. Wall-switch and exterior occupancy sensors.
 - 6. Communications outlets.
- B. See Division 27 Section "Communications Horizontal Cabling" for workstation outlets.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.
- C. Samples: One for each type of device and wall plate specified, in each color specified.
- D. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

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.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Basis of Design Product: As shown on Drawings.
- B. Comparable Products by, Hubbell,

2.2 STRAIGHT BLADE RECEPTACLES

- A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.

2.3 GFCI RECEPTACLES

- A. General Description: Straight blade, feed or non-feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.
- B. Duplex GFCI Convenience Receptacles, 125 V, 20 A.

2.4 SNAP SWITCHES

- A. Comply with NEMA WD 1 and UL 20.
- B. Switches, 120/277 V, 20 A.
- C. Pilot Light Switches, 20 A.
 - 1. Description: Single pole, with neon-lighted handle, illuminated when switch is "ON."
- D. Key-Operated Switches, 120/277 V, 20 A.
 - 1. Description: Single pole, with factory-supplied key in lieu of switch handle.
- E. Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors and where otherwise indicated.
- F. Key-Operated, Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors and where otherwise indicated, with factory-supplied key in lieu of switch handle.

2.5 WALL-BOX DIMMERS

- A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.
- B. Control: Continuously adjustable slider, toggle switch, or rotary knob; with single-pole or three-way switching. Comply with UL 1472.

- C. Incandescent Lamp Dimmers: 120 V; control shall follow square-law dimming curve. On-off switch positions shall bypass dimmer module.
 - 1. Wattage as shown on Drawings; dimmers shall require no derating when ganged with other devices.
- 2.6 FAN SPEED CONTROLS
 - A. Modular, 120-V, full-wave, solid-state units with integral, quiet on-off switches and audible frequency and EMI/RFI filters. Comply with UL 1917.
 - 1. Continuously adjustable slider, toggle switch, or rotary knob, 5 A.
 - 2. Three-speed adjustable slider or rotary knob, 1.5 A.
- 2.7 OCCUPANCY SENSORS
 - A. Wall-Switch Sensors:
 - 1. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 180-degree field of view, with a minimum coverage area of **900 sq. ft..**
 - B. Wall-Switch Sensors:
 - 1. Description: Adaptive-technology type, 120/277 V, adjustable time delay up to 20 minutes, 180-degree field of view, with a minimum coverage area of **900 sq. ft..**
 - C. Long-Range Wall-Switch Sensors:
 - 1. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 110-degree field of view, with a minimum coverage area of **1200 sq. ft..**
 - D. Long-Range Wall-Switch Sensors:
 - 1. Description: Dual technology, with both passive-infrared- and ultrasonic-type sensing, 120/277 V, adjustable time delay up to 30 minutes, 110-degree field of view, and a minimum coverage area of **1200 sq. ft..**
 - E. Wide-Range Wall-Switch Sensors:
 - 1. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 150-degree field of view, with a minimum coverage area of **1200 sq. ft..**
 - F. Exterior Occupancy Sensors:
 - 1. Description: Passive-infrared type, 120/277 V, weatherproof, adjustable time delay up to 15 minutes, 180-degree field of view, and **110-foot** detection range. Minimum switch rating: 1000-W incandescent, 500-VA fluorescent.
- 2.8 COMMUNICATIONS OUTLETS
 - A. Telephone Outlet:
 - 1. Description: Single RJ-45 jack for terminating 100-ohm, balanced, four-pair UTP; TIA/EIA-568-B.1 complying with Category 5e. Comply with UL 1863.
 - B. Combination TV and Telephone Outlet:
 - 1. Description: Single RJ-45 jack for 100-ohm, balanced, four-pair UTP; TIA/EIA-568-B.1; complying with Category 5e; and one Type F coaxial cable connector.
- 2.9 WALL PLATES
 - A. Single and combination types to match corresponding wiring devices.
 - 1. Plate-Securing Screws: Metal with head color to match plate finish.
 - 2. Material for Finished Spaces: **0.035-inch-** thick, satin-finished stainless steel.
 - 3. Material for Unfinished Spaces: Galvanized steel.
 - 4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in "wet locations."
 - B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant, die-cast aluminum with lockable cover.
- 2.10 FLOOR SERVICE FITTINGS
 - A. Type: Modular, **[flush-type]**, dual-service units suitable for wiring method used.
 - B. Compartments: Barrier separates power from voice and data communication cabling.
 - C. Service Plate: **[Round]**, **[die-cast aluminum]** with satin finish.
 - D. Power Receptacle: NEMA WD 6 configuration 5-20R, gray finish, unless otherwise indicated.

E. Voice and Data Communication Outlet: **[Blank cover with bushed cable opening]**.

2.11 FINISHES

- A. Color: Wiring device catalog numbers in Section Text do not designate device color.
1. Wiring Devices Connected to Normal Power System: Gray, unless otherwise indicated or required by NFPA 70 or device listing.
 2. Wiring Devices Connected to Emergency Power System: Red.
 3. TVSS Devices: Blue.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.
- B. Coordination with Other Trades:
1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
 2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
 3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
 4. Install wiring devices after all wall preparation, including painting, is complete.
- C. Conductors:
1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
 2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
 3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
 4. Existing Conductors:
 - a. Cut back and pigtail, or replace all damaged conductors.
 - b. Straighten conductors that remain and remove corrosion and foreign matter.
 - c. Pigtail existing conductors is permitted provided the outlet box is large enough.
- D. Device Installation:
1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
 2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
 3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
 4. Connect devices to branch circuits using pigtails that are not less than **6 inches** in length.
 5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
 6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
 7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
 8. Tighten unused terminal screws on the device.
 9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

- E. Receptacle Orientation:
 - 1. Install ground pin of vertically mounted receptacles [**down**], and on horizontally mounted receptacles to the [**right**].
 - F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
 - G. Dimmers:
 - 1. Install dimmers within terms of their listing.
 - 2. Verify that dimmers used for fan speed control are listed for that application.
 - 3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.
 - H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.
- 3.2 IDENTIFICATION
- A. Comply with Division 26 Section "Identification for Electrical Systems."
 - 1. Receptacles: Identify panelboard and circuit number from which served. Use durable wire markers or tags inside outlet boxes.
- 3.3 FIELD QUALITY CONTROL
- A. Perform tests and inspections and prepare test reports.
 - 1. Test Instruments: Use instruments that comply with UL 1436.
 - 2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.
 - B. Tests for Convenience Receptacles:
 - 1. Line Voltage: Acceptable range is 105 to 132 V.
 - 2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.
 - 3. Ground Impedance: Values of up to 2 ohms are acceptable.
 - 4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
 - 5. Using the test plug, verify that the device and its outlet box are securely mounted.
 - 6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new, and retest as specified above.
- END OF SECTION 262726

SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following individually mounted, enclosed switches and circuit breakers:
 - 1. Fusible switches.
 - 2. Nonfusible switches.
 - 3. Molded-case circuit breakers.
 - 4. Enclosures.

1.2 SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Field quality-control test reports.
- D. Operation and maintenance data.

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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 FUSIBLE AND NONFUSIBLE SWITCHES

- A. Manufacturers:
 - 1. Square D/Group Schneider.

- B. Fusible Switch, [600] A and Smaller: NEMA KS 1, Type [GD], with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
- C. Nonfusible Switch, [600] A and Smaller: NEMA KS 1, Type [GD], lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
- D. Accessories:
 - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 - 2. Neutral Kit: Internally mounted; insulated, capable of being grounded, and bonded; and labeled for copper and aluminum neutral conductors.
 - 3. Auxiliary Contact Kit: Auxiliary set of contacts arranged to open before switch blades open.

2.3 MOLDED-CASE CIRCUIT BREAKERS AND SWITCHES

- A. Manufacturers:
 - 1. Square D/Group Schneider.
- B. 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. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller and let-through ratings less than NEMA FU 1, RK-5.
 - 4. GFCI Circuit Breakers: Single- and two-pole configurations with [30]-mA trip sensitivity.
- C. Molded-Case Circuit-Breaker Features and Accessories:
 - 1. Standard frame sizes, trip ratings, and number of poles.
 - 2. Lugs: Mechanical style suitable for number, size, trip ratings, and conductor material.
 - 3. Application Listing: Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
 - 4. Ground-Fault Protection: **[Integrally mounted]** relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
 - 5. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at [55] percent of rated voltage.

2.4 ENCLOSURES

- A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.
 - 1. Outdoor Locations: NEMA 250, Type 3R.
 - 2. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
 - 3. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Coordinate size and location of concrete bases. Verify structural requirements with structural engineer.
- B. Concrete base is specified in Division 26 Section "Hangers and Supports for Electrical Systems," and concrete materials and installation requirements are specified in Division 03.
- C. Comply with applicable portions of NECA 1, NEMA PB 1.1, and NEMA PB 2.1 for installation of enclosed switches and circuit breakers.
- D. Mount individual wall-mounting switches and circuit breakers with tops at uniform height, unless otherwise indicated. Anchor floor-mounting switches to concrete base.
- E. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
- F. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- G. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Identification for Electrical Systems."

3.2 FIELD QUALITY CONTROL

- A. Prepare for acceptance testing as follows:
 - 1. Inspect mechanical and electrical connections.
 - 2. Verify switch and relay type and labeling verification.
 - 3. Verify rating of installed fuses.
- B. Perform the following field tests and inspections and prepare test reports:
 - 1. Perform each electrical test and visual and mechanical inspection stated 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.

END OF SECTION 262816

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SECTION 264313 - TRANSIENT-VOLTAGE SUPPRESSION FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes TVSSs for low-voltage power equipment.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating weights, operating characteristics, furnished specialties, and accessories.
- B. Field quality-control test reports.
- C. Operation and Maintenance Data.

1.3 QUALITY ASSURANCE

- A. Source Limitations: Obtain suppression devices and accessories through one source from a single manufacturer.
- B. 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.
- C. Comply with IEEE C62.41, "IEEE Guide for Surge Voltages in Low Voltage AC Power Circuits," and test devices according to IEEE C62.45, "IEEE Guide on Surge Testing for Equipment Connected to Low-Voltage AC Power Circuits."
- D. Comply with NEMA LS 1, "Low Voltage Surge Protection Devices."
- E. Comply with UL 1283, "Electromagnetic Interference Filters," and UL 1449 (3rd edition), "Transient Voltage Surge Suppressors."

1.4 PROJECT CONDITIONS

- A. Service Conditions: Rate surge protection devices for continuous operation under the following conditions, unless otherwise indicated:
 - 1. Maximum Continuous Operating Voltage: Not less than 115 percent of nominal system operating voltage.
 - 2. Operating Temperature: 30 to 120 deg F.
 - 3. Humidity: 0 to 85 percent, noncondensing.
 - 4. Altitude: Less than 20,000 feet above sea level.

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Advanced Protection Technologies, Inc.
 2. Cutler-Hammer, Inc.; Eaton Corporation.
 3. Intermatic, Inc.
 4. Leviton Mfg. Company Inc.
 5. Liebert Corporation; a division of Emerson.
 6. Siemens Energy & Automation, Inc.
 7. Square D; Schneider Electric.
 8. Tycor; Cutler-Hammer, Inc.

2.2 SERVICE ENTRANCE SUPPRESSORS

- A. Surge Protection Device Description: Non-modular, sine-wave-tracking type with the following features and accessories:
1. LED indicator lights for power and protection status.
 2. Audible alarm, with silencing switch, to indicate when protection has failed.
 3. Fuses, rated at 200-kA interrupting capacity.
 4. Integral disconnect switch.
 5. Redundant suppression circuits.
 6. Surge-event operations counter.
- B. Peak Single-Impulse Surge Current Rating: **[240]** kA per phase.
- C. Connection Means: Permanently wired.
- D. Protection modes and UL 1449 suppressed voltage rating for grounded wye circuits with voltages of **[208Y/120]**, 3-phase, 4-wire circuits shall be as follows:
1. Line to Neutral: [400 V for 208Y/120].
 2. Line to Ground: [400 V for 208Y/120].
 3. Neutral to Ground: [400 V for 208Y/120].
- E. Protection modes and UL 1449 suppressed voltage rating for 240/120-V, single-phase, 3-wire circuits shall be as follows:
1. Line to Neutral: 400 V.
 2. Line to Ground: 400 V.
 3. Neutral to Ground: 400 V.
- F. Protection modes and UL 1449 suppressed voltage rating for 240/120-V, 3-phase, 4-wire circuits with high leg shall be as follows:
1. Line to Neutral: 400 V, 800 V from high leg.
 2. Line to Ground: 400 V.
 3. Neutral to Ground: 400 V.
- G. Protection modes and UL 1449 suppressed voltage rating for voltages of 240 or 480, 3-phase, 3-wire, delta circuits shall be as follows:
1. Line to Line: [2000 V for 480 V] [1000 V for 240 V].

2. Line to Ground: [2000 V for 480 V] [1000 V for 240 V].

2.3 PANELBOARD SUPPRESSORS

- A. Surge Protection Device Description: Non-modular, sine-wave-tracking type with the following features and accessories:
 1. LED indicator lights for power and protection status.
 2. Audible alarm, with silencing switch, to indicate when protection has failed.
 3. Fuses, rated at 200-kA interrupting capacity.
 4. Integral disconnect switch.
 5. Redundant suppression circuits.
 6. Surge-event operations counter.
- B. Peak Single-Impulse Surge Current Rating: [120] kA per phase.
- C. Protection modes and UL 1449 suppressed voltage rating for grounded wye circuits with voltages of [208Y/120], 3-phase, 4-wire circuits shall be as follows:
 1. Line to Neutral: [400 V for 208Y/120].
 2. Line to Ground: [400 V for 208Y/120].
 3. Neutral to Ground: [400 V for 208Y/120].
- D. Protection modes and UL 1449 suppressed voltage rating for 240/120-V, single-phase, 3-wire circuits shall be as follows:
 1. Line to Neutral: 400 V.
 2. Line to Ground: 400 V.
 3. Neutral to Ground: 400 V.
- E. Protection modes and UL 1449 suppressed voltage rating for 240/120-V, 3-phase, 4-wire circuits with high leg shall be as follows:
 1. Line to Neutral: 400 V, 800 V from high leg.
 2. Line to Ground: 400 V.
 3. Neutral to Ground: 400 V.
- F. Protection modes and UL 1449 suppressed voltage rating for voltages of 240 or 480, 3-phase, 3-wire, delta circuits shall be as follows:
 1. Line to Line: [1000 V for 240 V].
 2. Line to Ground: [800 V for 240 V].

2.4 SUPPRESSORS FOR ELECTRONIC-GRADE PANELBOARDS

- A. Surge Protection Device Description: Sine-wave-tracking type, panel-mounted design with the following features and accessories:
 1. LED indicator lights for power and protection status.
 2. Audible alarm, with silencing switch, to indicate when protection has failed.
 3. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
- B. Peak Single-Impulse Surge Current Rating: [120] kA per phase.
- C. Protection modes and UL 1449 suppressed voltage rating for grounded wye circuits with voltages of [208Y/120], 3-phase, 4-wire circuits shall be as follows:
 1. Line to Neutral: [400 V for 208Y/120].

2. Line to Ground: [400 V for 208Y/120].
 3. Neutral to Ground: [400 V for 208Y/120].
- D. Protection modes and UL 1449 suppressed voltage rating for 240/120-V, single-phase, 3-wire circuits shall be as follows:
1. Line to Neutral: 400 V.
 2. Line to Ground: 400 V.
 3. Neutral to Ground: 400 V.
- E. Protection modes and UL 1449 suppressed voltage rating for 240/120-V, 3-phase, 4-wire circuits with high leg shall be as follows:
1. Line to Neutral: 400 V, 800 V from high leg.
 2. Line to Ground: 400 V.
 3. Neutral to Ground: 400 V.
- F. Protection modes and UL 1449 suppressed voltage rating for voltages of 240, 480, or 600, 3-phase, 3-wire, delta circuits shall be as follows:
1. Line to Line: [1000 V for 240 V].
 2. Line to Ground: [800 V for 240 V].

2.5 ENCLOSURES

- A. NEMA 250, with type matching the enclosure of panel or device being protected.

PART 3 - EXECUTION

3.1 INSTALLATION OF SURGE PROTECTION DEVICES

- A. Install devices at service entrance on load side, with ground lead bonded to service entrance ground. Install devices on all emergency panels per NEC 700.8. Install on all normal power panels.
- B. Install devices for panelboard and auxiliary panels with conductors or buses between suppressor and points of attachment as short and straight as possible. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.
1. Provide multipole, [60] -A circuit breaker as a dedicated disconnect for suppressor, unless otherwise indicated.

3.2 PLACING SYSTEM INTO SERVICE

- A. Do not energize or connect **[service entrance equipment] [panelboards] [control terminals] [data terminals]** to their sources until surge protection devices are installed and connected.

3.3 FIELD QUALITY CONTROL

- A. Testing: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports:

- B. Testing: Perform the following field tests and inspections and prepare test reports:
1. Complete startup checks according to manufacturer's written instructions.
 2. Perform each visual and mechanical inspection and electrical test stated in NETA ATS, "Surge Arresters, Low-Voltage Surge Protection Devices" Section. Certify compliance with test parameters.

END OF SECTION 264313

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SECTION 265100 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Interior lighting fixtures, lamps, and ballasts.
 - 2. Emergency lighting units.
 - 3. Exit signs.
 - 4. Lighting fixture supports.
 - 5. Retrofit kits for fluorescent lighting fixtures.
- B. See Division 26 Section "Wiring Devices" for manual wall-box dimmers for incandescent lamps.
- C. See Division 26 Section "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.

1.2 SUBMITTALS

- A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes.
- B. Shop Drawings: Show details of nonstandard or custom lighting fixtures. Indicate dimensions, weights, methods of field assembly, components, features, and accessories.
- C. Product Certificates: For each type of ballast for bi-level and dimmer-controlled fixtures, signed by product manufacturer.
- D. Field quality-control test reports.

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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In Interior Lighting Fixture Schedule where titles below are column or row headings that introduce lists, the following requirements apply to product selection:
 - 1. Basis-of-Design Product: The design for each lighting fixture is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.
 - 2. Pre-approved manufacturers: Cooper Industries, Lithonia, Philips, Lite Source and Hubbell.

2.2 LIGHTING FIXTURES AND COMPONENTS, GENERAL REQUIREMENTS

- A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.
- B. Metal Parts: Free of burrs and sharp corners and edges.
- C. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.
- D. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- E. Reflecting surfaces shall have 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.

- F. Plastic Diffusers, Covers, and Globes:
 - 1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 - a. Lens Thickness: At least **0.125 inch** minimum unless different thickness is indicated.
 - b. UV stabilized.
 - 2. Glass: Annealed crystal glass, unless otherwise indicated.
- 2.3 EXIT SIGNS
 - A. Internally Lighted Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.
 - 1. Lamps for AC Operation: LEDs, 70,000 hours minimum rated lamp life.
- 2.4 EMERGENCY LIGHTING UNITS
 - A. Description: Self-contained units complying with UL 924.
 - 1. Battery: Sealed, maintenance-free, lead-acid type.
 - 2. Charger: Fully automatic, solid-state type with sealed transfer relay.
 - 3. Operation: Relay automatically turns lamp on when power 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 from battery, and battery is automatically recharged and floated on charger.
 - 4. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - 5. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
- 2.5 LAMPS
 - A. LED: color temperature [**4000**] K,
- 2.6 LIGHTING FIXTURE SUPPORT COMPONENTS
 - A. Comply with Division 26 Section "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.
 - B. Single-Stem Hangers: **1/2-inch** steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.
 - C. Twin-Stem Hangers: Two, **1/2-inch** steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.
 - D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, [**12 gage**].
 - E. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, [**12 gage**].
 - F. Rod Hangers: **3/16-inch** minimum diameter, cadmium-plated, threaded steel rod.
 - G. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Lighting fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.
- B. Comply with NFPA 70 for minimum fixture supports.
- C. Suspended Lighting Fixture Support:
 - 1. Pendants and Rods: Where longer than **48 inches**, brace to limit swinging.
 - 2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
 - 3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
- D. Air-Handling Lighting Fixtures: Install with dampers closed and ready for adjustment.
- E. Adjust aimable lighting fixtures to provide required light intensities.

- F. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- G. For 2x4 fixtures in suspended ceilings, install support wires (ceiling hanger wires) from 2 diagonal corners directly to structure, independent of ceiling grid.

3.2 FIELD QUALITY CONTROL

- A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.
- B. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

END OF SECTION 265100

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SECTION 270500 - COMMON WORK RESULTS FOR COMMUNICATIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Sleeves for pathways and cables.
 - 2. Sleeve seals.
 - 3. Grout.
 - 4. Common communications installation requirements.

1.2 SUBMITTALS

- A. Product Data: For sleeve seals.

PART 2 - PRODUCTS

2.1 SLEEVES FOR PATHWAYS AND CABLES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- C. Sleeves for Rectangular Openings: Galvanized sheet steel.
 - 1. Minimum Metal Thickness:
 - a. For sleeve cross-section rectangle perimeter less than **50 inches** and no side more than **16 inches**, thickness shall be **0.052 inch**.
 - b. For sleeve cross-section rectangle perimeter equal to, or more than, **50 inches** and 1 or more sides equal to, or more than, **16 inches**, thickness shall be **0.138 inch**.

2.2 SLEEVE SEALS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and pathway or cable.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Metraflex Co.
 - d. Pipeline Seal and Insulator, Inc.
 - 2. Sealing Elements: **[EPDM] [NBR]** interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of pathway or cable.
 - 3. Pressure Plates: **[Carbon steel]**. Include two for each sealing element.
 - 4. Connecting Bolts and Nuts: **[Carbon steel with corrosion-resistant coating]** of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.3 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR COMMUNICATIONS INSTALLATION

- A. Comply with NECA 1.
- B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
- C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both communications equipment and other nearby installations.

Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

- E. Right of Way: Give to piping systems installed at a required slope.
- 3.2 SLEEVE INSTALLATION FOR COMMUNICATIONS PENETRATIONS
 - A. Communications penetrations occur when pathways, cables, wireways, or cable trays penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.
 - B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
 - C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
 - D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
 - E. Cut sleeves to length for mounting flush with both surfaces of walls.
 - F. Extend sleeves installed in floors 2 inches above finished floor level.
 - G. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and pathway or cable, unless indicated otherwise.
 - H. Seal space outside of sleeves with grout for penetrations of concrete and masonry
 - 1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.
 - I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and pathway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."
 - J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pathway and cable penetrations. Install sleeves and seal pathway and cable penetration sleeves with firestop materials. Comply with requirements in Division 26 Section "Penetration Firestopping."
 - K. Roof-Penetration Sleeves: Seal penetration of individual pathways and cables with flexible boot-type flashing units applied in coordination with roofing work.
 - L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using [steel] pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 - M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between pathway or cable and sleeve for installing mechanical sleeve seals.
- 3.3 SLEEVE-SEAL INSTALLATION
 - A. Install to seal exterior wall penetrations.
 - B. Use type and number of sealing elements recommended by manufacturer for pathway or cable material and size. Position pathway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pathway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- 3.4 FIRESTOPPING
 - A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for communications installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 26 Section "Penetration Firestopping."

END OF SECTION 270500

SECTION 271100 - COMMUNICATIONS EQUIPMENT ROOM FITTINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Telecommunications mounting elements.
 - 2. Backboards.
 - 3. Telecommunications service entrance pathways.
 - 4. Grounding.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For communications equipment room fittings. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail equipment assemblies, and location and size of each field connection.
 - 2. Equipment racks and cabinets: Include workspace requirements and access for cable connections.
 - 3. Grounding: Indicate location of grounding bus bar and its mounting detail.
- C. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
 - 1. Layout Responsibility: Preparation of Shop Drawings shall be under the direct supervision of RCDD.
 - 2. Installation Supervision: Installation shall be under the direct supervision of Level 2 Installer, who shall be present at all times when Work of this Section is performed at Project site.
 - 3. Field Inspector: Currently registered by BICSI as RCDD to perform the on-site inspection.
- B. 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.
- C. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.
- D. Grounding: Comply with ANSI-J-STD-607-A.

1.4 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install equipment frames and cable trays until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and work above ceilings is complete.

1.5 COORDINATION

- A. Coordinate layout and installation of communications equipment with Owner's telecommunications and LAN equipment and service suppliers. Coordinate service entrance arrangement with local exchange carrier.
 - 1. Meet jointly with telecommunications and LAN equipment suppliers, local exchange carrier representatives, and Owner to exchange information and agree on details of equipment arrangements and installation interfaces.
 - 2. Record agreements reached in meetings and distribute them to other participants.
 - 3. Adjust arrangements and locations of distribution frames, cross-connects, and patch panels in equipment rooms to accommodate and optimize arrangement and space requirements of telephone switch and LAN equipment.

PART 2 - PRODUCTS

2.1 PATHWAYS

- A. Cable Support: NRTL labeled. Cable support brackets shall be designed to prevent degradation of cable performance and pinch points that could damage cable. Cable tie slots fasten cable ties to brackets.
 - 1. Comply with NFPA 70 and UL 2043 for fire-resistant and low-smoke-producing characteristics.
 - 2. Support brackets with cable tie slots for fastening cable ties to brackets.
 - 3. Lacing bars, spools, J-hooks, and D-rings.
 - 4. Straps and other devices.
- B. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems." Flexible metal conduit shall not be used.
 - 1. Outlet boxes shall be no smaller than 2 inches wide, 3 inches high, and 2-1/2 inches deep.

2.2 BACKBOARDS

- A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches. Comply with requirements for plywood backing panels specified in Division 06 Section "Rough Carpentry."

2.3 GROUNDING

- A. Comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems" for grounding conductors and connectors.
- B. Telecommunications Main Bus Bar:
 - 1. Connectors: Mechanical type, cast silicon bronze, solderless compression or exothermic-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.
 - 2. Ground Bus Bar: Copper, minimum 1/4 inch thick by 4 inches wide with 9/32-inch holes spaced 1-1/8 inches apart.
 - 3. Stand-Off Insulators: Comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.
- C. Comply with ANSI-J-STD-607-A.

2.4 LABELING

- A. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

PART 3 - EXECUTION

3.1 ENTRANCE FACILITIES

- A. Contact telecommunications service provider and arrange for installation of demarcation point, protected entrance terminals, and a housing when so directed by service provider.
- B. Install underground pathways complying with recommendations in TIA/EIA-569-A, "Entrance Facilities" Article.

3.2 Install underground entrance pathway complying with Division 26 Section "Raceway and Boxes for Electrical Systems."

3.3 INSTALLATION

- A. Comply with NECA 1.
- B. Comply with BICSI TDMM for layout and installation of communications equipment rooms.
- C. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A-7.
- D. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

3.4 FIRESTOPPING

- A. Comply with requirements in Division 07 Section "Penetration Firestopping." Comply with TIA/EIA-569-A, Annex A, "Firestopping."
- B. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.5 GROUNDING

- A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. Comply with ANSI-J-STD-607-A.
- C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.
- D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

3.6 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements in Division 26 Section "Identification for Electrical Systems." Comply with requirements in Division 09 Section "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.
- B. See Division 27 Section "Communications Horizontal Cabling" for additional identification requirements. See Evaluations for discussion of TIA/EIA standard as it applies to this Section. Paint and label colors for equipment identification shall comply with TIA/EIA-606-A for Class 2 level of administration.
- C. Labels shall be preprinted or computer-printed type.

END OF SECTION 271100

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SECTION 283111 - DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Manual fire-alarm boxes.
 - 2. System smoke detectors.
 - 3. Heat detectors.
 - 4. Notification appliances.
 - 5. Magnetic door holders.
 - 6. Addressable interface device.

1.2 SYSTEM DESCRIPTION

- A. Integrate with Existing, addressable system, with multiplexed signal transmission, dedicated to fire-alarm service only.

1.3 PERFORMANCE REQUIREMENTS

- A. Comply with NFPA-72 and South Carolina Office of State Fire Marshall Guidelines for Fire Alarms in State Owned Buildings.

1.4 SUBMITTALS

- A. General Submittal Requirements:
 - 1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
 - 2. Shop Drawings shall be prepared by persons with the following qualifications:
 - a. Trained and certified by manufacturer in fire-alarm system design.
 - b. NICET-certified fire-alarm technician, Level III minimum.
- B. Product Data: For each type of product indicated.
- C. Shop Drawings: For fire-alarm system. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72.
 - 2. Include voltage drop calculations for notification appliance circuits.
 - 3. Include battery-size calculations.
 - 4. Include performance parameters and installation details for each detector, verifying that each detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
 - 5. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale and coordinating installation of duct smoke detectors and access to them. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators. Locate detectors according to manufacturer's written recommendations.
 - 6. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits.
- D. Qualification Data: For qualified Installer.
- E. Seismic Qualification Certificates: For fire-alarm control unit, accessories, and components, from manufacturer.
- F. Field quality-control reports.
- G. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
 - 1. Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
 - 2. Provide "Record of Completion Documents" according to NFPA 72 article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter.

3. Record copy of site-specific software.
 4. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of the same name and include the following:
 - a. Frequency of testing of installed components.
 - b. Frequency of inspection of installed components.
 - c. Requirements and recommendations related to results of maintenance.
 - d. Manufacturer's user training manuals.
 5. Manufacturer's required maintenance related to system warranty requirements.
 6. Abbreviated operating instructions for mounting at fire-alarm control unit.
 7. Copy of NFPA 25.
 - H. Software and Firmware Operational Documentation:
 1. Software operating and upgrade manuals.
 2. Program Software Backup: On magnetic media or compact disk, complete with data files.
 3. Device address list.
 4. Printout of software application and graphic screens.
- 1.5 QUALITY ASSURANCE
- A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.
 - B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level II technician.
 - C. Source Limitations for Fire-Alarm System and Components: Obtain fire-alarm system from single source from single manufacturer. Components shall be compatible with, and operate as, an extension of existing system.
 - D. 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.
- 1.6 SOFTWARE SERVICE AGREEMENT
- A. Comply with UL 864.
 - B. Technical Support: Beginning with Substantial Completion, provide software support for two years.
 - C. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.
 1. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide **[product indicated on Drawings]** or comparable product by one of the following:
 1. MATCH OWNER'S PREFERRED VENDOR

2.2 SYSTEMS OPERATIONAL DESCRIPTION

- A. Fire-alarm signal initiation shall be by one or more of the following devices and systems:
 1. Manual stations.
 2. Heat detectors.
 3. Smoke detectors.
 4. Duct smoke detectors.
 5. Automatic sprinkler system water flow.
 6. Heat detectors in elevator shaft and pit.
 7. Fire-extinguishing system operation.

8. Fire standpipe system.
 - B. Fire-alarm signal shall initiate the following actions:
 1. Continuously operate alarm-notification appliances.
 2. Identify alarm at the fire-alarm control unit and remote annunciators.
 3. Transmit an alarm signal to the remote alarm receiving station.
 4. Unlock electric door locks in designated egress paths.
 5. Release fire and smoke doors held open by magnetic door holders.
 6. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
 7. Recall elevators to primary or alternate recall floors.
 8. Activate emergency lighting control.
 9. Activate emergency shutoffs for gas and fuel supplies.
 10. Record events in the system memory.
 - C. Supervisory signal initiation shall be by one or more of the following devices and actions:
 1. Valve supervisory switch.
 2. Low-air-pressure switch of a dry-pipe sprinkler system.
 3. Elevator shunt-trip supervision.
 - D. System trouble signal initiation shall be by one or more of the following devices and actions:
 1. Open circuits, shorts, and grounds in designated circuits.
 2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
 3. Loss of primary power at fire-alarm control unit.
 4. Ground or a single break in fire-alarm control unit internal circuits.
 5. Abnormal ac voltage at fire-alarm control unit.
 6. Break in standby battery circuitry.
 7. Failure of battery charging.
 8. Abnormal position of any switch at fire-alarm control unit or annunciator.
 - E. System Trouble and Supervisory Signal Actions: Initiate notification appliance and annunciate at fire-alarm control unit and remote annunciators.
- 2.3 FIRE-ALARM CONTROL UNIT
- A. General Requirements for Fire-Alarm Control Unit:
 1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864 and listed and labeled by an NRTL.
 - a. System software and programs shall be held in flash electrically erasable programmable read-only memory (EEPROM), retaining the information through failure of primary and secondary power supplies.
 - b. Include a real-time clock for time annotation of events on the event recorder and printer.
 2. Addressable control circuits for operation of mechanical equipment.
 - B. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.
 1. Annunciator and Display: Liquid-crystal type, 3 line(s) of 40 characters, minimum.
 2. Keypad: Arranged to permit entry and execution of programming, display, and control commands and to indicate control commands to be entered into the system for control of smoke-detector sensitivity and other parameters.
 3. Keyed access for control.
 - C. Circuits:
 1. Initiating Device, Notification Appliance, and Signaling Line Circuits: NFPA 72, Class A.

- a. Initiating Device Circuits: Style D.
 - b. Notification Appliance Circuits: Style Z.
 - c. Signaling Line Circuits: Style 6.
 - d. Install no more than 50 addressable devices on each signaling line circuit.
 - D. Elevator Recall:
 - 1. Smoke detectors indicated on drawings shall initiate automatic elevator recall. Alarm-initiating devices, except those listed, shall not start elevator recall.
 - 2. Elevator lobby detectors located on the designated recall floors shall be programmed to move the cars to the alternate recall floor.
 - 3. Water-flow alarm connected to sprinkler in an elevator shaft and elevator machine room shall shut down elevators associated with the location without time delay.
 - a. Water-flow switch associated with the sprinkler in the elevator pit may have a delay to allow elevators to move to the designated floor.
 - E. Door Controls: Door hold-open devices that are controlled by smoke detectors at doors in smoke barrier walls shall be connected to fire-alarm system.
 - F. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.
 - G. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory and digital alarm communicator transmitters shall be powered by 24-V dc source.
 - 1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.
 - H. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.
 - 1. Batteries: Sealed lead calcium.
 - I. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.
- 2.4 MANUAL FIRE-ALARM BOXES
- A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.
 - 1. Double-action mechanism requiring two actions to initiate an alarm, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
 - 2. Station Reset: Key- or wrench-operated switch.
 - 3. Indoor Protective Shield: Muckle type cover with scored plexiglass front, no hammer.
 - 4. Weatherproof Protective Shield: Factory-fabricated clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm.
 - 5. General Public areas such as lobbies to have Alarm cover.
- 2.5 SYSTEM SMOKE DETECTORS
- A. General Requirements for System Smoke Detectors:
 - 1. Comply with UL 268; operating at 24-V dc, nominal.
 - 2. Detectors shall be four-wire type.
 - 3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
 - 4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.

5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
 6. Integral Visual-Indicating Light: LED type indicating detector has operated and power-on status.
 - B. Photoelectric Smoke Detectors:
 1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
 2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - a. Primary status.
 - b. Device type.
 - c. Present average value.
 - d. Present sensitivity selected.
 - e. Sensor range (normal, dirty, etc.).
 - C. Duct Smoke Detectors: Photoelectric type complying with UL 268A.
 1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
 2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - a. Primary status.
 - b. Device type.
 - c. Present average value.
 - d. Present sensitivity selected.
 - e. Sensor range (normal, dirty, etc.).
 3. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector.
 4. Each sensor shall have multiple levels of detection sensitivity.
 5. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
 6. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.
 7. Remote indicator/test switch as shown on drawings.
- 2.6 HEAT DETECTORS
- A. General Requirements for Heat Detectors: Comply with UL 521.
 - B. Heat Detector, Combination Type: Actuated by either a fixed temperature of **135 deg F** or a rate of rise that exceeds **15 deg F** per minute unless otherwise indicated.
 1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
 2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
 - C. Heat Detector, Fixed-Temperature Type: Actuated by temperature that exceeds a fixed temperature of **190 deg F**.
 1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
 2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
- 2.7 NOTIFICATION APPLIANCES
- A. General Requirements for Notification Appliances: Connected to notification appliance signal circuits, zoned as indicated, equipped for mounting as indicated and with screw terminals for system connections.
 1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated and with screw terminals for system connections.
 - B. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure

level of 90 dBA, measured **10 feet** from the horn, using the coded signal prescribed in UL 464 test protocol.

- C. Visible Notification Appliances: Xenon strobe lights comply with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum **1-inch-** high letters on the lens.

1. Rated Light Output:
 - a. 15/30/75/110 cd, selectable in the field, set for 110 cd.
2. Mounting: Wall mounted unless otherwise indicated.
3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
4. Flashing shall be in a temporal pattern, synchronized with other units.
5. Strobe Leads: Factory connected to screw terminals.
6. Mounting Faceplate: Factory finished, red.

2.8 MAGNETIC DOOR HOLDERS

- A. Description: Units are equipped for wall or floor mounting as indicated and are complete with matching doorplate.

1. Electromagnet: Requires no more than 3 W to develop **25-lbf** holding force.
2. Wall-Mounted Units: Flush mounted unless otherwise indicated.
3. Rating: 24-V ac or dc.

- B. Material and Finish: Match door hardware.

2.9 REMOTE ANNUNCIATOR

- A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.

1. Mounting: Flush cabinet, NEMA 250, Type 1.

- B. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

2.10 ADDRESSABLE INTERFACE DEVICE

- A. Description: Microelectronic monitor module, NRTL listed for use in providing a system address for alarm-initiating devices for wired applications with normally open contacts.

- B. Integral Relay: Capable of providing a direct signal to equipment as required.

2.11 DIGITAL ALARM COMMUNICATOR TRANSMITTER

- A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632 and be listed and labeled by an NRTL.

- B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture two telephone line(s) and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service on either line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.

- C. Local functions and display at the digital alarm communicator transmitter shall include the following:

1. Verification that both telephone lines are available.
2. Programming device.
3. LED display.
4. Manual test report function and manual transmission clear indication.
5. Communications failure with the central station or fire-alarm control unit.

- D. Digital data transmission shall include the following:

1. Address of the alarm-initiating device.

2. Address of the supervisory signal.
3. Address of the trouble-initiating device.
4. Loss of ac supply or loss of power.
5. Low battery.
6. Abnormal test signal.
7. Communication bus failure.
- E. Secondary Power: Integral rechargeable battery and automatic charger.
- F. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

- A. Comply with NFPA 72 for installation of fire-alarm equipment.
- B. Equipment Mounting: Install fire-alarm control unit to wall with tops of cabinets not more than **72 inches** above the finished floor.
- C. Smoke- or Heat-Detector Spacing:
 1. Comply with NFPA 72, "Smoke-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for smoke-detector spacing.
 2. Comply with NFPA 72, "Heat-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for heat-detector spacing.
 3. Smooth ceiling spacing shall not exceed **30 feet**.
 4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Appendix A or Appendix B in NFPA 72.
 5. HVAC: Locate detectors not closer than **3 feet** from air-supply diffuser or return-air opening.
 6. Lighting Fixtures: Locate detectors not closer than **12 inches** from any part of a lighting fixture.
- D. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct.
- E. Heat Detectors in Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location.
- F. Remote Status and Alarm Indicators: Install near each duct smoke detector and each sprinkler water-flow switch and valve-tamper switch that is not readily visible from normal viewing position.
- G. Audible Alarm-Indicating Devices: Install as shown on drawings. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.
- H. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least **6 inches** below the ceiling.
- I. Device Location-Indicating Lights: Locate in public space near the device they monitor.
- J. Fire-Alarm Control Unit: Surface mounted, with tops of cabinets not more than **72 inches** above the finished floor.
- K. Annunciator: Install with top of panel not more than **72 inches** above the finished floor.

3.2 CONNECTIONS

- A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Division 08 Section "Door Hardware." Connect hardware and devices to fire-alarm system.
 1. Verify that hardware and devices are NRTL listed for use with fire-alarm system in this Section before making connections.
- B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than **3 feet** from the device controlled.

Make an addressable confirmation connection when such feedback is available at the device or system being controlled.

1. Alarm-initiating connection to smoke-control system (smoke management) at firefighter smoke-control system panel.
2. Alarm-initiating connection to elevator recall system and components.
3. Alarm-initiating connection to activate emergency lighting control.
4. Alarm-initiating connection to activate emergency shutoffs for gas and fuel supplies.
5. Supervisory connections at valve supervisory switches.
6. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.
7. Supervisory connections at elevator shunt trip breaker.
8. Supervisory connections at fire-pump power failure including a dead-phase or phase-reversal condition.
9. Supervisory connections at fire-pump engine control panel.

3.3 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."
- B. Install framed instructions in a location visible from fire-alarm control unit.

3.4 GROUNDING

- A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

3.5 FIELD QUALITY CONTROL

- A. Field tests shall be witnessed by Engineer, authorities having jurisdiction and Owner.
- B. Tests and Inspections:
 1. Visual Inspection: Conduct visual inspection prior to testing.
 - a. Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.
 - b. Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
 2. System Testing: Comply with "Test Methods" Table in the "Testing" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
 3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
 4. Test audible appliances for the private operating mode according to manufacturer's written instructions.
 5. Test visible appliances for the public operating mode according to manufacturer's written instructions.
 6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
- C. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.
- D. Fire-alarm system will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

- F. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.
- G. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

END OF SECTION 283111

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SECTION 284800 - EMERGENCY RESPONSE SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Emergency responder communications enhancement systems.
2. Two-way emergency communications systems for rescue assistance.

B. Related Requirements:

1. Section 260011 "Facility Performance Requirements for Electrical" for seismic-load, wind-load, acoustical, and other field conditions applicable to Work specified in this Section.
2. Section 280010 "Supplemental Requirements for Electronic Safety and Security" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
3. Section 284621.11 "Addressable Fire-Alarm Systems" for interfacing emergency response systems with fire-alarm systems.
4. Section 284700 "Mass Notification" for interfacing emergency response systems with mass notification systems.

1.2 DEFINITIONS

- A. BDA: Bi-directional amplifier.
- B. ERCES: Emergency responder communications enhancement system.
- C. PES: Public emergency service.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Coordination Meeting(s): For emergency communications systems. Conduct meeting(s) **[as videoconference]** **[or]** **[at Project site]** at pre-construction meeting.
- B. Electrical contractor to coordinate with sub-consultant to evaluate the site upon building completion. Electrical contractor will carry the cost to evaluate the site in their construction budget.
- C. Installation fee. The electrical contractor is to carry an installation allowance of \$50,000 to be applied towards the design, purchase, installation, and testing of the system.

1.4 ACTION SUBMITTALS

A. Product Data:

1. ERCESs:
 - a. BDAs.
 - b. In-building service antennas.
 - c. Outdoor donor antenna.
 - d. Coaxial cabling.
 - e. Couplers and splitters.
 - f. Remote indicator panels.
2. Two-Way Emergency Communications Systems for Rescue Assistance:
 - a. Master control station.
 - b. Remote communications stations.

B. Shop Drawings:

1. Project general notes.
2. ERCESs:
 - a. Device layout.
 - b. Block diagrams and cable/conduit routing.
 - c. Pathway class and survivability identification.
 - d. System communications details.
 - e. System sequence of operations.
 - f. System mounting details.
 - g. Secondary power calculations.
3. Two-Way Emergency Communications Systems for Rescue Assistance:
 - a. Device layout.
 - b. Block diagrams and cable/conduit routing.
 - c. Pathway class and survivability identification.
 - d. System communications details.
 - e. System sequence of operations.
 - f. System mounting details.
 - g. Secondary power calculations.

C. Certificates:

1. Certification from each system [**manufacturer**] that equipment and components are compatible and represent a complete system in accordance with NFPA 72, NFPA 1221, and specified requirements.

D. Field Quality-Control Submittals:

1. Field quality-control reports.

1.5 INFORMATIONAL SUBMITTALS

- A. Manufacturers' Published Instructions: Record copy of official installation[**and testing**] instructions issued to Installer by manufacturer for the following:
 - 1. Installation instructions for ERCESs.
 - 2. Installation instructions for two-way emergency communications systems for rescue assistance.
 - 3. Recommended tests and inspections for ERCESs.
 - 4. Recommended tests and inspections for two-way emergency communications systems for rescue assistance.
- B. Baseline Radio Signal Strength Testing Report:
 - 1. Detailed report indicating NFPA 72 or NFPA 1221 plotted interior radio signal strength or delivered audio quality score throughout building critical and general areas with construction of interior partitions and doors completed, but without ERCES installed.
 - 2. Approval from authorities having jurisdiction to omit ERCES installation within building areas where baseline radio signal strength testing demonstrates that minimum required radio signal strength values are provided within these areas.
- C. System Record of Inspection and Testing: Record copy of completed system acceptance testing.[**Format must be approved by authorities having jurisdiction.**]
- D. Sample warranties.

1.6 CLOSEOUT SUBMITTALS

- A. Warranty documentation.

1.7 REGULATORY AGENCY APPROVALS

- A. Submittals for emergency communications systems requiring approval by authorities having jurisdiction must be signed and sealed by qualified electrical professional engineer or qualified fire protection professional engineer responsible for their preparation. [**Submit for action by Architect prior to submitting for approval by authorities having jurisdiction.**]
- B. Submittals for emergency communications systems require action by Architect prior to submitting for approval by authorities having jurisdiction.

1.8 WARRANTY FOR EMERGENCY RESPONSE SYSTEMS

- A. Special Installer Extended Warranty: Installer warrants that fabricated and installed ERCES performs in accordance with specified requirements and agrees to repair or replace components or products that fail to perform as specified within extended-warranty period.
 - 1. Extended-Warranty Period: [**Two**] years from date of Substantial Completion; full coverage for labor, materials, and equipment.

- B. Special Manufacturer Extended Warranty: Manufacturer warrants that ERCES performs in accordance with specified requirements and agrees to provide repair or replacement of components or products that fail to perform as specified within extended-warranty period.
1. **[Initial]** Extended-Warranty Period: **[Five]** years from date of Substantial Completion; **[prorated]** coverage for labor, materials, and equipment.
 2. Follow-On Extended-Warranty Period: **[Eight]** years from date of Substantial Completion; **[prorated]** coverage for materials **[that failed because of transient voltage surges]** only, free on board **[destination]**, freight prepaid.

1.9 WARRANTY FOR BATTERIES

- A. Special Manufacturer Extended Warranty for Batteries: Manufacturer warrants that batteries perform in accordance with specified requirements and agrees to provide repair or replacement of batteries that fail to perform as specified within extended-warranty period.
1. Initial Extended-Warranty Period for Li-ion Batteries: **[Five]** years from date of Substantial Completion; full coverage for materials only, free on board **[destination]**, freight prepaid.
 2. Follow-On Extended-Warranty Period for Li-ion Batteries: **[Ten]** years from date of Substantial Completion; prorated coverage for materials only, free on board **[destination]**, freight prepaid.
 3. Extended-Warranty Period for Ni-MH Batteries: **[Three]** years from date of Substantial Completion; prorated coverage for materials only, free on board **[destination]**, freight prepaid.
 4. Extended-Warranty Period for Ni-Cd Batteries: **[Five]** years from date of Substantial Completion; prorated coverage for materials only, free on board **[destination]**, freight prepaid.
 5. Warranted Cycle Life for Valve Regulated (Sealed) **[Lead Calcium]** Batteries: Equal to or greater than that represented in manufacturer's published table, but not less than the following, based on annual average battery temperature of **77 deg F (25 deg C)**:
 - a. For discharge rate not faster than eight hours, discharge duration not longer than eight hours, and voltage at end of discharge not less than 1.67 V, warranted life must be not fewer than six discharge cycles.
 - b. For discharge rate not faster than 30 minutes, discharge duration not longer than 30 minutes, and voltage at end of discharge not less than 1.67 V, warranted life must be not fewer than 20 discharge cycles.
 - c. For discharge rate not faster than 15 minutes, discharge duration not longer than 45 seconds, and voltage at end of discharge not less than 1.67 V, warranted life must be not fewer than 120 discharge cycles.
 6. Warranted Cycle Life for Premium Valve Regulated (Sealed) **[Lead Calcium]** **[or]** Batteries: Equal to or greater than that represented in manufacturer's published table, but not less than the following, based on annual average battery temperature of **77 deg F (25 deg C)**:
 - a. For discharge rate not faster than eight hours, discharge duration not longer than eight hours, and voltage at end of discharge not less than 1.67 V, warranted life must be not fewer than 40 discharge cycles.

- b. For discharge rate not faster than 30 minutes, discharge duration not longer than 30 minutes, and voltage at end of discharge not less than 1.67 V, warranted life must be not fewer than 125 discharge cycles.
- c. For discharge rate not faster than 15 minutes, discharge duration not longer than 90 seconds, and voltage at end of discharge not less than 1.67 V, warranted life must be not fewer than 750 discharge cycles.

PART 2 - PRODUCTS

2.1 EMERGENCY RESPONDER COMMUNICATIONS ENHANCEMENT SYSTEMS

- A. Description: This category includes in-building ERCES equipment to improve wireless communication. This FCC-certified enhancement system is inclusive of BDA, transmission lines, cables, power supplies, antennas, and other ancillary equipment that allows radio signals to pass to and from interior of structure for facilitating radio communications using PES radio frequencies.
- B. Performance Criteria:
 - 1. Regulatory Requirements:
 - a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
 - b. Unless otherwise indicated in Contract Documents, products must comply with NFPA 1, NFPA 70, NFPA 72, NFPA 1221, [NFPA 101,] [ICC IBC,] [ICC IFC,] and local regulations enforced by authorities having jurisdiction.
- C. In-Building ERCES Bi-Directional Amplifiers
 - 1. Manufacturers
 - a. Gamewell- FCI
 - b. Notifier
 - c. Silent Knight
 - 2. Listing Criteria: UL CCN UTMH; including UL 2524 and NFPA 1221.
 - 3. Options:
 - a. Primary Power Supply: [120 V(ac)].
 - b. Secondary Power Supply: [24 V(dc)] supply system including batteries, automatic float-charge battery charger, and automatic transfer switch.
 - c. Supervision: Auxiliary contacts for remote status supervision by [protected premises fire-alarm system].
 - 1) Signal booster failure.
 - 2) Antenna malfunction.
 - 3) Loss of primary power.
 - 4) Low battery voltage.
 - 5) Battery charger failure.

- d. Cabinet Enclosures: [UL 50E, Type 4] steel enclosure for amplifiers and power supplies.
- e. Mounting: [Surface] mount.
- f. Finish: [Factory-finish red enamel].

D. In-Building ERCES Distributed Antennas:

- 1. Manufacturers
 - a. Fractal Antenna Systems
 - b. Laird Connectivity
- 2. Options:
 - a. Type: [Wide-band omnidirectional] [and] [multi-band] [single-band].
 - b. Mounting: Low-profile [ceiling] mount.

E. In-Building ERCES Donor Antennas:

- 1. Manufacturers
 - a. Fractal Antenna Systems
 - b. Laird Connectivity
- 2. Options:
 - a. Configuration: Factory assembled and tuned directional UHF Yagi antenna.
 - b. Mounting: [Stainless steel] mounting hardware.
 - c. Finish: [Welded] [or] [seamless] corrosion-resistant aluminum construction.
 - d. Wind Velocity Rating: [Comply with minimum ICC IBC requirements].

F. RF Antenna Cable Couplers and Splitters:

- 1. Manufacturers
 - a. CommScope
 - b. Mini-Circuits
- 2. Options:
 - a. Configuration: Nominal [0.5 inch (13 mm)], [50 Ω], N-Type, weatherproof, medium-size, RF couplers and splitters for coaxial cables.
 - b. Bandwidth: [As required by in-building emergency radio enhancement system performance requirements].
 - c. Gain (dB) Rating: [As required by in-building emergency radio enhancement system performance requirements].
 - d. Environmental Rating: [Type 4 and][IP65].

G. Remote Indicator Panel:

- 1. Manufacturers
 - a. Space Age Technologies
- 2. Options:

- a. Primary Power Supply: **[120 V(ac)]**.
- b. Secondary Power Supply: **[24 V(dc)]** supply system including batteries, automatic float-charge battery charger, and automatic transfer switch.
- c. Configuration: Zone indicator panel with LED indicators[, **piezoelectric sounder**] and switches for lamp test and alarm silence.
- d. LED Indicators: Green indicator for primary power in normal state; red indicators for each individual fault status required to be indicated by authorities having jurisdiction.
- e. Enclosure: **[16-gauge steel]** with factory-applied red enamel finish.

2.2 TWO-WAY EMERGENCY COMMUNICATIONS SYSTEMS FOR RESCUE ASSISTANCE

- A. Description: This category includes equipment for providing two-way emergency voice communication for areas of refuge, stairway landings, elevator landings, and occupant evacuation elevator lobbies in accordance with NFPA 72.
- B. Performance Criteria:
 1. Regulatory Requirements:
 - a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
 - b. Unless otherwise indicated in Contract Documents, products must comply with NFPA 1, NFPA 70, NFPA 72, **[NFPA 101,]** **[ICC IBC,]** **[ICC IFC,]** and local regulations enforced by authorities having jurisdiction.
 2. Listing Criteria: UL 2525 and NFPA 72.
- C. General Characteristics:
 1. Master Control Station: Mount **[in fire command center (if provided)]** or **[in constantly attended location]** to provide power, supervision, and control for two-way emergency communications systems for rescue assistance.
 - a. Power Supply: **[24 V(dc)]** supply system including batteries, automatic float-charge battery charger, and automatic transfer switch.
 - b. Communicate between master control station handset and remote communications stations.
 - c. Annunciate visual and audible signal at master control station when remote telephone handset is lifted from cradle or when phone is plugged into designated remote jack.
 - d. Silence audible signal when master control station handset is removed and remote telephone handset is acknowledged.
 - e. Display identification for location of remote communications stations in building.
 2. Remote Communications Stations: **[double-gang]**, stainless steel-plate mounted station with hands-free, two-way communication.
 3. Pathway Survivability:

- a. Riser Cables: **[Level 2 or 3]**.
- b. Feeder Cables: **[Level 0]**.

PART 3 - EXECUTION

3.1 COMMON INSTALLATION REQUIREMENTS FOR EMERGENCY RESPONSE SYSTEMS

- A. Comply with manufacturer's published instructions.
- B. Reference Standards:
 - 1. Unless more stringent requirements are specified in Contract Documents or manufacturers' published instructions, comply with NFPA 1, NFPA 70, NFPA 72, NFPA 1221, **[NFPA 101,]** **[ICC IBC,]** **[ICC IFC,]** and local regulations enforced by authorities having jurisdiction for installation of emergency communications systems.
 - 2. Comply with NECA 305 for installation of emergency communications systems devices and their connections to fire-alarm system.
 - 3. Consult **[Architect]** **[Owner]** for resolution of conflicting requirements.
- C. Installation for Survivability:
 - 1. Where NFPA 72 or NFPA 1221 Survivability Level 2 or 3 pathways are indicated or required, install cables and pathways within 2-hour fire-resistance-rated enclosures or provide fire-resistive pathway installation in accordance with NFPA 72 or NFPA 1221.
 - 2. Install control equipment, power supplies, junction boxes, terminal cabinets, or similar components within dedicated 2-hour fire-resistance-rated fire-alarm system equipment rooms if components originate from or comprise a portion of NFPA 72 or NFPA 1221 Survivability Level 2 or 3 pathway.

3.2 INSTALLATION OF ERCES

- A. Special Techniques:
 - 1. Antenna Wiring Methods:
 - a. Coaxial Cabling:
 - 1) Riser Coaxial Cable: Type CATVR, nominal **[0.5 inch (13 mm)]**, **[50 Ω]** coaxial jacketed cable with corrugated **[copper]** **[or]** **[aluminum]** outer conductor.
 - 2) Plenum Coaxial Cable: Type CATVP, nominal **[0.5 inch (13 mm)]**, **[50 Ω]** coaxial jacketed cable with corrugated **[copper]** **[or]** **[aluminum]** outer conductor.
 - 3) Plenum Radiating Coaxial Cable: Type CATVP, nominal **[0.5 inch (13 mm)]**, **[50 Ω]** radiating coaxial jacketed cable with corrugated **[copper]** **[or]** **[aluminum]** outer conductor.

- 4) Connectors: Nominal [**0.5 inch (13 mm)**], [**50 Ω**] N-Type, weatherproof, medium-size, RF connectors for coaxial cables.
- b. Pathway Survivability:
 - 1) Riser Coaxial Cables: [**Level 2 or 3**].
 - 2) Feeder Coaxial Cables: [**Level 0**].
2. Determine in-building service antenna locations based on baseline radio signal strength testing.
3. Request approval from authorities having jurisdiction to omit emergency responder radio coverage system from areas of building where baseline radio signal strength testing demonstrates that minimum required radio signal strength values are achieved without radio coverage system.
4. Install outdoor donor antenna with clear view to donor site with minimum [**2 ft (0.6 m)**] vertical clearance above nearby obstacles.
- B. Interfaces with Other Work:
 1. Coordinate installation of new products for emergency responder radio coverage systems with existing conditions.
 2. Coordinate with [**Section 284621.11 "Addressable Fire-Alarm Systems"**] [**Section 284621.13 "Conventional Fire-Alarm Systems"**] for interfaces with fire-alarm system.
- 3.3 INSTALLATION OF TWO-WAY EMERGENCY COMMUNICATIONS SYSTEMS FOR RESCUE ASSISTANCE
 - A. Interfaces with Other Work:
 1. Coordinate installation of new products for two-way emergency communications systems for rescue assistance with existing conditions.
 2. Coordinate with [**Section 284621.11 "Addressable Fire-Alarm Systems"**] [**Section 284621.13 "Conventional Fire-Alarm Systems"**] for interfaces with fire-alarm system.
- 3.4 IDENTIFICATION
 - A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 270553 "Identification for Communications Systems."
- 3.5 FIELD QUALITY CONTROL OF EMERGENCY RESPONDER RADIO COVERAGE SYSTEMS
 - A. Field tests and inspections must be witnessed by [**authorities having jurisdiction**].
 - B. Tests and Inspections:

1. Perform manufacturer's recommended tests and inspections.
2. Perform field tests and inspections required by NFPA 72 and NFPA 1221.
3. Baseline radio signal strength testing.

C. Nonconforming Work:

1. Device will be considered defective if it does not pass tests and inspections.
2. Remove and replace defective units and retest.

D. Collect, assemble, and submit test and inspection reports.

E. Manufacturer Services:

1. Engage factory-authorized service representative to **[support]** **[supervise]** field tests and inspections.

3.6 FIELD QUALITY CONTROL OF TWO-WAY EMERGENCY COMMUNICATIONS SYSTEMS FOR RESCUE ASSISTANCE

A. Field tests and inspections must be witnessed by **[authorities having jurisdiction]**.

B. Tests and Inspections:

1. Perform manufacturer's recommended tests and inspections.
2. Perform field tests and inspections required by NFPA 72 and NFPA 1221.

C. Nonconforming Work:

1. Device will be considered defective if it does not pass tests and inspections.
2. Remove and replace defective units and retest.

D. Collect, assemble, and submit test and inspection reports.

E. Manufacturer Services:

1. Engage factory-authorized service representative to **[support]** **[supervise]** field tests and inspections.

3.7 PROTECTION

- A. After installation, protect emergency communications systems devices from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

END OF SECTION 284800

SECTION 32 12 16 - ASPHALT PAVING

PART 1 - GENERAL

1.1 SUMMARY

- A. This section covers all work associated with:
 - 1. Aggregate Base Course
 - 2. Intermediate Course
 - 3. Base Course
 - 4. Prime Coat
 - 5. Tack Coat
 - 6. Asphaltic Concrete

1.2 DEFINITIONS

- A. Compaction: The process of mechanically stabilizing a material by increasing its density. "Degree of Compaction" is expressed as a percentage of the maximum density obtained by the test procedure described in ASTM D 1557 for general soil types or ASTM D 4253 or ASTM D 4254 for isolated cohesionless materials, abbreviated in this specification as "___ percent maximum density." "Degree of Compaction" is expressed as a percentage of the maximum density obtained by the test procedure ASTM D 1188 or ASTM D 2726 "___ percent maximum density for asphaltic concrete."
- B. Course: A layer or lift of soil or asphaltic concrete placed on top of a previously prepared or placed surface.
- C. Lift: A layer or course of soil or asphaltic concrete placed on top of a previously prepared or placed surface.
- D. Subgrade: Existing, in-situ soil or other material that is remaining after stripping or excavation. The subgrade is always existing material on which fill, or new structures are to be placed.

1.3 SUBMITTALS

- A. Asphaltic Concrete Mix Design: For each mix to be used on the project by course, submit a mix design prepared within 12 months of the date of the submittal.
 - 1. Mix designs in compliance with requirements of the "North Carolina Department of Transportation Standard Specifications for Roads and Structures". Mix design shall bear the approval of the North Carolina Department of Transportation State Highway Department and shall be dated within 24 months of the date of the submittal. All materials listed in the mix design shall be the materials used to produce the asphaltic concrete.
- B. Laboratory Testing: Submit laboratory testing data for approval as identified in the paragraph titled "Laboratory Testing" for any the following materials to be used on the project before any material is delivered to the site.
 - 1. Graded Aggregate Base Course
 - a. Maximum density
 - 2. Asphaltic Concrete (intermediate course and surface course)
 - a. Maximum density
- C. Field Testing: Submit field testing data as identified in the paragraph titled "Field Testing" for the following:

1. Aggregate Base Course
 - a. In place densities
 - b. Grade
 - c. Straight Edge
 2. Asphaltic Concrete (intermediate course and surface course)
 - a. In place density
 - b. Mix Design Compliance
 - c. Grade
 - d. Straight Edge
- D. Certifications: Provide manufacturer or supplier certification of compliance indicating conformance to this specification or the referenced standard(s) for the following:
1. Aggregate Base Course
 2. Tack coat
 3. Prime coat
 4. Asphaltic Concrete (intermediate course and surface course)
 - a. Coarse aggregate
 - b. Fine aggregate
 - c. Mineral filler
 - d. Asphalt cement

1.4 DELIVERY, STORAGE AND HANDLING

- A. Deliver and store materials in a manner to prevent contamination or segregation. Do not stockpile materials in a manner or location that will cause excessive wetting or transporting of materials off-site or into storm drainage collection systems.

1.5 REGULATORY REQUIREMENTS

- A. Comply with federal, state and local regulatory requirements.

1.6 CRITERIA FOR BIDDING

- A. Lump Sum Price
1. The items listed in the proposal shall be considered as sufficient to complete the work in accordance with the plans and specifications. Any portion of the work not specifically listed in the bid form shall be deemed a part of the item with which is it associated and shall be included in the lump sum price. The price shall be full compensation for the material, compaction, shaping, finishing, dressing, disposal of surplus material, testing, construction supervision and all other work required for satisfactory completion of the asphaltic concrete pavement system.
- B. Unit Prices
1. None this Section.

1.7 QUALITY ASSURANCE

- A. Materials: All material submittals shall be submitted by the contractor and reviewed and accepted in writing by the Engineer prior to ordering of any materials.

- B. Manufacturer: Material and equipment shall be the standard products of a manufacturer who has manufactured them for a minimum of 2 years and who provides published data on the quality and performance of the projects.
- C. Subcontractor: A subcontractor for any part of the work must have experience on similar work. At the option of the Engineer, a list of projects and the Owners or Engineers who are familiar with his competence may be required to be submitted to verify experience.
- D. Design: Devices, equipment, structures, and systems not designed by the Engineer that the Contractor wishes to furnish shall be designed by either a registered professional engineer or by someone the Engineer accepts as qualified. Complete design calculations and assumptions shall be furnished to the Engineer or Owner before acceptance.
- E. Environmental Conditions: Place bituminous mixture only during dry weather and on dry surfaces. Place asphaltic concrete only when surface temperature of underlying course is greater than 45 degrees F for course thicknesses greater than one inch and 55 degrees F for course thickness' one inch or less.
- F. Equipment: Shall be well maintained, suited for the intended work and capable of delivering the finished product to the standards shown on drawings and as specified herein.

PART 2 - PRODUCTS

2.1 BASE COURSE

- A. Graded Aggregate Base Course
 - 1. Shall comply with requirements for Graded Aggregate Base Course as specified in Section 520 of the "North Carolina Department of Transportation Standard Specifications for Roads and Structures" and addendums.

2.2 PRIME COAT

- A. Shall comply with requirement for Prime Coat specified in Section 600 of the "North Carolina Department of Transportation Standard Specifications for Roads and Structures".

2.3 TACK COAT

- A. Shall comply with requirement for Tack Coat specified in Section 605 of the "North Carolina Department of Transportation Standard Specifications for Roads and Structures".

2.4 ASPHALTIC CONCRETE

- A. Shall be hot mixed, hot laid asphaltic concrete of the compacted thickness indicated.
- B. Intermediate course
 - a. Shall comply with requirements for Hot Mix Asphalt Intermediate course Type I19.0B as specified in Sections 610 of the "North Carolina Department of Transportation Standard Specifications for Roads and Structures".
- C. Surface Course:
 - 1. Shall comply with requirements for Hot Mix Asphalt Surface Course Type SF9.5C as specified in Sections 610 of the "North Carolina Department of Transportation Standard Specifications for Roads and Structures".

PART 3 - EXECUTION

3.1 SAWCUTTING OF EXISTING PAVEMENTS

- A. Provide full depth sawcuts through existing asphaltic concrete pavements where new asphaltic concrete pavements are to join. Sawcuts shall be straight and vertical and shall be located a minimum of 3 inches from the existing edge or as indicated on the drawings.

3.2 PREPARATION OF SUBGRADE OR FILL

- A. Prepare subgrade and/or fill as specified in SECTION "EARTH MOVING".

3.3 BASE COURSES

- A. Graded Aggregate Base Course

- 1. Placement

- a. Place aggregate base on prepared subgrade or fill in maximum loose lifts of 8 inches. Do not place on surfaces that are muddy, frozen or that contain frost. Total thickness shall be as indicated. Compact with equipment well suited for material being compacted. Moisten or aerate material as necessary to provide the moisture content that will readily facilitate obtaining the specified compaction with the equipment being used. Compact each lift as specified herein prior to placing the overlaying lift.

- 2. Compaction

- a. Compact the base course through the full depth to not less than 100 percent of maximum laboratory density.

- 3. Tolerances

- a. Finished grade of base course shall be within 0.05 feet of indicated finish grade.
 - b. Finished surface of base course shall not vary more than 3/8 inch when tested with a 10-foot straightedge.
 - c. Finished thickness of base course shall not vary more than one-half inch from the required thickness at any point and the average of all depth measurements shall be at least that indicated.
 - d. Areas not meeting the specified requirements will be rejected until corrected by the Contractor

- 4. Protection

- a. Graded areas shall be protected from traffic, erosion, settlement, or any washing away that may occur from any cause prior to acceptance. Any repair or re-establishment of final grades shall be made prior to final acceptance.

3.4 PRIME COAT

- A. Application

- 1. Apply not more than 0.28 gallon per square yard nor less than 0.25 gallon per square yard to the completed and accepted base course after receiving approval from the Engineer for priming. Where base consists of fossiliferous limestone, the prime rate shall be not more than 0.15 gallons per square yard nor less than 0.10 gallons per square yard. The prime shall only be applied when the base course is only slightly damp, and when temperature of the air in the shade is 55 degrees F or above. In places where the distributor bars cannot reach, it will be necessary to apply the prime coat with a hand sprayer attached to the distributor by a hose.

- B. Protection

- 1. Do not permit traffic on the primed area until the prime coat has cured adequately.

3.5 TACK COAT

- A. Application

1. Apply not more than 0.15-gallon square yard nor less than 0.05 gallon per square yard to indicated contact surfaces. Net rate of application shall be 0.10 gallon per square yard of net bitumen. Apply half-rate application to prime coats that have been contaminated by traffic or dust. The tack coat shall only be applied when the contact surface is dry and when the temperature has not been below 35 degrees F for 12 hours immediately prior to application. The tack coat shall only be applied when the temperature of the air in the shade is 55 degrees F or above. Work shall be planned so that no more tack coat than is necessary for the day's operation is placed on the surface. In places where the distributor bars cannot reach, it will be necessary to apply the tack coat with a hand sprayer attached to the distributor by a hose. When hand spray methods are used, care should be taken to give the surface a very light application of the asphalt.

B. Protection

1. Except paving equipment, do not permit any traffic on tacked surfaces.

3.6 ASPHALTIC CONCRETE

A. Mixing and Preparation of Bituminous Mixture

1. Plant mix bituminous mixture to comply with requirements specified herein.

B. Transportation of Bituminous Mixture

1. Transport bituminous mixture in trucks having, tight, clean, smooth beds that have been coated with a minimum amount of a concentrated solution of hydrated lime and water to prevent adhesion of the mixture to the truck bodies. Each load shall be covered with canvas or other approved material of ample size to protect the mixture from the weather and to prevent loss of heat. Deliveries shall be made so that the spreading and rolling of all mixture prepared for one day's run can be completed during daylight, unless adequate, approved artificial lighting is provided. The mixture shall be delivered to the area to be paved in such a manner that the temperature at the time of dumping into the spreader will not be less than 250 degrees F. Any loads that are below minimum temperature, that have crusts of cold, unworkable material, or that have been wet excessively by rain will be rejected. Hauling over freshly laid material will not be permitted.

C. Machine Spreading

1. Prior to the laying of the asphaltic concrete, clean underlying course of foreign or objectionable matter with power blowers or power brooms, supplemented by hand brooms and other cleaning methods where necessary.
2. The range of temperatures of the mixtures at the time of spreading shall be between 250 degrees F and 300 degrees F. Bituminous concrete having temperatures less than minimum spreading temperature when dumped into the spreader will be rejected. Adjust spreader and regulate speed so that the surface of the course is smooth and continuous without tears and pulling, and of such depth that, when compacted, the surface conforms with the cross section, grade, and contour indicated. Unless otherwise directed, begin the placing along the centerline of areas to be paved on a crowned section or on the high side of areas with a one-way slope. Place mixture in consecutive adjacent strips having a minimum width of 10 feet, except where the edge lanes require strips less than 10 feet to complete the area. Construct longitudinal joints and edges to true line markings. Establish lines parallel to the centerline of the area to be paved, and place string lines coinciding with the established lines for the spreading machine to follow. Provide the number and location of the lines needed to accomplish proper grade control. When specified grade and smoothness requirements can be met for initial lane construction by use of an approved long ski-type device of not less than 30 feet in length and for subsequent lane construction by use of a short ski or shoe, in-place string lines for grade

control may be omitted. Place mixture as nearly continuous as possible and adjust the speed of placing as needed to permit proper rolling

D. Shoveling, Raking, and Tamping After Machine Spreading

1. Shovelers and rakers shall follow the spreading machine. Add or remove hot mixture and rake the mixture as required to obtain a course that when completed will conform to requirements specified herein. Broadcasting or fanning of mixture over areas being compacted is prohibited. When segregation occurs in the mixture during placing, suspend spreading operation until the cause is determined and corrected. Correct irregularities in alignment left by the spreader by trimming directly behind the machine. Immediately after trimming, compact edges of the course by tamping laterally with a metal lute or by other approved methods. Distortion of the course during tamping is prohibited.

E. Hand Spreading in Lieu of Machine Spreading

1. In areas where the use of machine spreading is impractical, spread mixture by hand. The range of temperatures of the mixtures when dumped onto the area to be paved shall be between 250 and 300 degrees F. Mixtures having temperatures less than minimum spreading temperature when dumped onto the area to be paved will be rejected. Spread hot mixture with rakes in a uniformly loose layer of a thickness that, when compacted, will conform to the required grade, thickness, and smoothness. During hand spreading, place each shovel full of mixture by turning the shovel over in a manner that will prevent segregation. Do not place mixture by throwing or broadcasting from a shovel. Do not dump loads any faster than can be properly handled by the shovelers and rakers.

F. Compaction of Mixture

1. Compact mixture by rolling. Begin rolling as soon as placement of mixture will bear rollers. Delays in rolling freshly spread mixture shall not be permitted. Start rolling longitudinally at the extreme sides of the lanes and proceed toward center of pavement, or toward high side of pavement with a one-way slope. Operate rollers so that each trip overlaps the previous adjacent strip by at least one foot. Alternate trips of the roller shall be of slightly different lengths. Conduct tests for conformity with the specified crown, grade and smoothness immediately after initial rolling. Before continuing rolling, correct variations by removing or adding materials as necessary. If required, subject course to diagonal rolling with the steel wheeled roller crossing the lines of the previous rolling while mixture is hot and in a compactible condition. Speed of the rollers shall be slow enough to avoid displacement of hot mixture. Correct displacement of mixture immediately by use of rakes and fresh mixture or remove and replace mixture as directed. Continue rolling until roller marks are eliminated and course has a density of at least 96 percent but not more than 100 percent of that attained in a laboratory specimen of the same mixture prepared in accordance with ASTM D 1559. During rolling, moisten wheels of the rollers enough to prevent adhesion of mixture to wheels, but excessive water is prohibited. Operation of rollers shall be by competent and experienced operators. Provide sufficient rollers for each spreading machine in operation on the job and to handle plant output. In places not accessible to the rollers, compact mixture thoroughly with hot hand tampers. Skin patching of an area after compaction is prohibited. Remove mixture that becomes mixed with foreign materials or is defective and replace with fresh mixture compacted to the density specified herein. Roller shall pass over unprotected edge of the course only when laying of course is to be discontinued for such length of time as to permit mixture to become cold.

G. Tolerances

1. Finished grade of asphaltic concrete shall be within 0.03 feet of indicated finish grade.

2. Finished surface shall not vary more than 1/8 inch when tested with a 10-foot straightedge.
3. The finished thickness shall not vary more than 1/4 inch from required thickness at any point and average thickness of depth measurements shall be at least the thickness indicated.
4. The finished surface shall be uniform in appearance and texture over the entire surface, including at joints. The entire surface shall be free of evidence of segregation, honeycombs and back scattering.
5. Areas not meeting the above requirements will be rejected until corrected by the Contractor.

H. Joints

1. Joints shall present the same texture and smoothness as other portions of the course, except permissible density at the joint may be up to 2 percent less than the specified course density. Carefully make joints between old and new pavement or within new pavements in a manner to ensure a thorough and continuous bond between old and new sections of the course. Vertical contact surfaces of previously constructed sections that are coated with dust, sand, or other objectionable material shall be painted with a thin uniform coat of emulsion or other approved bituminous material just before placing fresh mixture.
2. Transverse Joints
 - a. Roller shall pass over unprotected end of freshly laid mixture only when laying of course is to be discontinued. Except when an approved bulkhead is used, cut back the edge of previously laid course to expose an even, vertical surface for the full thickness of the course. When required, rake fresh mixture against joints, thoroughly tamp with hot tampers, smooth with hot smoothers, and roll. Transverse joints in adjacent lanes shall be offset a minimum of 2 feet.
3. Longitudinal Joints
 - a. Space 6 inches apart. Do not allow joints to coincide with joints of existing pavement or previously placed courses. Spreader screed shall overlap previously placed lanes 2 to 3 inches and be of such height to permit compaction to produce a smooth dense joint. With a lute, push back mixture placed on the surface of previous lanes to the joint edge. Do not scatter mix. Remove and waste excess material. When edges of longitudinal joints are irregular, honeycombed, or poorly compacted, cut back unsatisfactory sections of joint and expose an even vertical surface for the full thickness of the course. When required, rake fresh mixture against joint, thoroughly tamp with hot tampers, smooth with hot smoothers, and roll while hot.

I. Protection

1. Do not permit traffic, including heavy equipment, on asphaltic concrete until surface temperature has cooled to at least 120 degrees F.

3.7 PROTECTION

A. Existing Pavement

1. Protect existing pavements to remain from damage. Movement of construction machinery and equipment over existing pavements during construction shall be at the Contractor's risk. Existing pavements damaged by the contractor's operations shall be repaired or replaced to their original condition at the contractor's expense.

B. Erosion Control

1. Protect existing streams, ditches, and storm drain inlets from water-borne soil by the means indicated on the contract drawings.

C. Existing Utilities

1. Location of the existing utilities indicated is approximate. The Contractor shall physically verify the location and elevation of the existing utilities indicated prior to starting construction. The Contractor shall contact the local utility location company or each applicable utility company as required for assistance in locating existing utilities.

D. Structures and surfaces

1. Protect newly backfilled areas and adjacent structures, slopes, or grades from traffic, erosion settlement, or any other damage. Repair and reestablish damaged or eroded grades and slopes and restore surface construction prior to acceptance.

3.8 INSPECTION AND TESTING

A. Inspections

1. The Engineer will have the right to require that any portion of the work be done in his presence and if the work is covered up after such instruction, it shall be exposed by the Contractor for observation. However, if the Contractor notifies the Engineer that such work is scheduled, and the Engineer fails to appear within 72 hours, the Contractor may proceed without him. All work done, and materials furnished shall be subject to review by the Engineer or the Project Representative, and all improper work shall be reconstructed, and all materials which do not conform to the requirements of the specifications shall be removed from the work upon notice being received from the Engineer for the rejection of such materials. The Engineer shall have the right to mark rejected materials so as to distinguish them as such.
2. The Contractor shall give the Project Engineer or Project Representative a minimum of 72 hours notice for all required observations or tests.

B. Testing

1. All testing shall be made at the Owner's expense. Test locations shall be approved by the Engineer.
2. Test results shall be furnished to the Contractor, Engineer and Owner within 72 hours after field tests are taken.
3. The testing laboratory, Engineer and Owner shall be given a minimum of 72 hours notice for all tests. Testing Agencies - Testing shall be done by a testing laboratory which operates in accordance with ASTM E-329 (latest revision) and approved by the Engineer prior to engagement. Mill certificates of tests on materials made by the manufacturers will be accepted provided the manufacturer maintains an adequate testing laboratory, makes regularly scheduled tests that are spot checked by an outside laboratory, and furnishes satisfactory certificates with the name of the one making the test. Agencies to be used shall be submitted to the Engineer for review prior to engagement.
4. Laboratory Testing
 - a. Graded Aggregate Base Course
 - 1) Laboratory testing for maximum density and optimum moisture content shall be performed in accordance with ASTM D 1557 or ASTM D 698 for general soil types or ASTM D 4253 or ASTM D 4254 for isolated cohesionless materials.

- 2) Aggregate Base - One maximum density and optimum moisture content test for each source.

5. Field testing

- a. Independent Testing Laboratory shall prepare test reports that indicate test location, elevation data, and test results. The Owner, Engineer, and Contractor shall be provided copies of reports within 72 hours of the time the test was performed. In the event that any test performed fails to meet these specifications, the Owner, Engineer, and Contractor shall be notified immediately by Independent Testing Laboratory. The Owner reserves the right to employ an Independent Testing Laboratory and to direct any testing that it may deem necessary. The Contractor shall provide free access to the site for testing activities.
- b. Graded Aggregate Base Courses:
 - 1) In-place density – 1 per 1000 square yards per course and per lift - in accordance with one of the following:
 - a) Sand Cone Method - ASTM D 1556
 - b) Balloon Method - ASTM D 2167
 - c) Nuclear Method - ASTM D 2922
 - 2) Grade - entire site. (50 feet grid maximum)
 - 3) Straightedge - entire site (25 feet grid maximum)
- c. Asphaltic Concrete (intermediate course, surface course):
 - 1) Maximum density of compacted asphaltic concrete shall be determined in accordance with ASTM D 1188 or ASTM D 2726.
 - a) One density test for each batch, but no less than one test for each 250 tons of asphaltic concrete produced or fraction thereof of asphalt produced.
 - 2) Mix design compliance - Test asphaltic concrete produced for compliance with the approved mix design in accordance with the Marshall Method for Mix Design in the Asphalt Institute Manual Series No. 2 (MS-2).
 - a) One analysis for each batch, but no less than one analysis for each 250 tons of asphaltic concrete produced or fraction thereof of asphalt produced.
 - 3) In place density - 1 per 1000 square yards per course and per lift - in accordance with one of the following:
 - a) ASTM D 2950
 - b) Determine by taking 4" diameter cores obtained from intermediate course and surface course. Separate course by sawing. Determine in-place density of cores in accordance ASTM D 1188 or ASTM D 2726.
 - 4) Grade - entire site. (50 feet grid maximum)
 - 5) Straightedge - entire site (25 feet grid maximum)

C. Acceptance

1. In the event that a tested material does not meet or exceed the specified requirements, the Contractor shall perform additional testing as directed by the Engineer to adequately

define the limits of the material not meeting the specifications. Materials shall be re-tested to the satisfaction of the Engineer until specified requirements are met.

2. All additional testing and work, which is the result of a failed test, shall be performed by the Contractor at no additional cost to the Owner.

END OF SECTION 32 12 16

SECTION 331100 - SITE POTABLE WATER UTILITIES

PART 1 - GENERAL

1.1 SUMMARY

- A. This section covers work associated with the furnishing and installation of water distribution piping and related components outside the building for fire sprinkler services to include backflow preventers, valves, hydrants, thrust restraints and thrust blocking.

1.2 DEFINITIONS

- A. Water distribution includes underground water-service piping and associated components outside the building.
- B. Water-service piping conveys potable water to the building for domestic water distribution inside the building.
- C. Fire-service-main piping conveys water to the building for fire suppression.
- D. Subgrade: Existing, in-situ soil or other material that is remaining after stripping or excavation. The subgrade is always existing material on which fill or new structures are to be placed.
- E. Excavation: The removal of soil or material to obtain a specified depth or elevation.
- F. Borrow: Material that must be transported to the site. A material that must be developed by others and transported to the site. Not available on site.
- G. Backfill: Fill material used in refilling a cut, trench, or other excavation.
- H. Lift: A layer or course of material placed on top of a previously prepared or placed material.
- I. Unsuitable Material: Existing, in situ soil or other material which can be identified as having insufficient strength characteristics or stability to carry intended loads in fill or embankment without excessive consolidation or loss of stability. Materials classified as PT, OH, or OL by ASTM D 2487 are unsuitable. Unsuitable materials also include man-made fills, refuse, frozen material, uncompacted backfills from previous construction, unsound rock or soil lenses, or other deleterious or objectionable material.
- J. Granular Material: Soils classified as GW, GP, SW or SP by ASTM D 2487. Materials classified as GM and SM will be identified as granular only when fines have a plasticity index of zero.
- K. Compaction: The process of mechanically stabilizing a material by increasing its density at a controlled moisture condition. "Degree of Compaction" is expressed as a percentage of the maximum density obtained by the test procedure described in ASTM D 1557 for general soil types or ASTM D 4253 or ASTM D 4254 for isolated cohesionless materials, abbreviated in this specification as "___ percent maximum density."
- L. Bedding: The subgrade or fill material that directly supports the load of a pipe.

1.3 LUMP SUM PRICE

- A. The items listed in the Bid shall be considered sufficient to complete the work in accordance with the drawings and specifications. Any portion of the work not specifically listed in the bid form shall be deemed a part of the item with which it is associated and shall be included in the lump sum price. The price shall be full compensation for the excavating, filling, transporting of material, compaction, shaping, finishing, dressing, disposal of surplus material, inspection, testing, staking, construction supervision and all other work required for satisfactory installation of the potable water system.

1.4 UNIT PRICES

- A. None this Section.

1.5 SUBMITTALS

A. Dewatering Plan

1. Describe methods for removing collected water from open trenches and diverting surface water or piped flow away from work area. Describe equipment and procedures for installing and operating the dewatering system indicated. Describe the basic components of the dewatering system proposed for use and its planned method of operation. Record performance and effectiveness of method or system in use. The dewatering plan shall address, as a minimum, the requirements identified in the paragraph titled "Drainage and Dewatering."

B. Shoring and Sheet Piling Plan

1. Describe the materials of the shoring system to be used. Indicate whether or not components will remain after filling or backfilling. Provide plans, sketches, or details along with calculations by a professional engineer. Indicate sequence and method of installation and removal.

C. Certifications: Provide manufacturer or supplier certification of compliance indicating conformance to this specification or the referenced standard(s) for each lot of pipe type to be used in this project:

1. Water Main Piping
 - a. Ductile Iron Pipe
2. Water Service Piping
 - a. DIP
3. Valves, hydrants, and other appurtenances
 - a. Valves
 - b. Backflow Preventers
 - c. Hydrants
 - d. Valve Boxes
 - e. Tapping Machines
 - f. Meters

D. NFPA 24 Certification

1. The Contractor shall perform all flushing, testing, and material certification in order to complete a "Contractor's Material and Test Certificate" in accordance with NFPA 24 requirements for all underground fire protection piping from the branch at water main to the sprinkler riser.
2. The completed, signed certificate shall be provided to the Owner's representative; with copies to the project Architect and Engineer.

E. Laboratory Testing: Submit test results as identified in the paragraph titled "Laboratory Testing" for the following:

1. Bacteriological Testing

F. Field Testing: Submit field test results as identified in the paragraph titled "Field Testing" for the following:

1. Hydrostatic and Leakage Testing

G. Operational Closeout Documentation

1. Record Drawings
2. Valve Cards
3. Easement Plats

1.6 DELIVERY, STORAGE AND HANDLING

A. Delivery and Storage

1. Piping: Inspect materials delivered to site for damage; store with minimum of handling. Store plastic piping and jointing materials and rubber gaskets under cover out of direct sunlight. Do not store materials directly on the ground. Keep inside of pipes and fittings free of dirt and debris.
2. Metal items: Check upon arrival; identify and segregate as to types, functions, and sizes. Store off the ground in a manner affording easy accessibility and not causing excessive rusting or coating with grease or other objectionable materials.

B. Handling

1. Handle pipe, fittings, and other accessories in a manner to ensure delivery to the trench in sound undamaged condition. Take special care not to damage coatings and linings on pipe and fittings; if damaged, make repairs. Carry pipe to trench - do not drag.

1.7 REGULATORY REQUIREMENTS

- A. Comply with Federal, State, and local regulations.

1.8 QUALITY ASSURANCE

- A. Materials: The Contractor will furnish the Engineer and Owner all submittals identified in the paragraph "Submittals" before ordering. The Engineer will review the Contractor's submittals and provide in writing an acceptance or rejection of material.
- B. Manufacturer: Material and equipment shall be the standard products of a manufacturer who has manufactured them for a minimum of 2 years and who provides published data on the quality and performance of the projects.
- C. Subcontractor: A subcontractor for any part of the work must have experience on similar work. At the option of the Engineer, a list of projects and the contacts who are familiar with his competence may be required to be submitted to verify experience.
- D. Design: Devices, equipment, structures, and systems not designed by the Engineer that the Contractor wishes to furnish shall be designed by either a registered professional engineer or by someone the Engineer accepts as qualified. Complete design calculations and assumptions shall be furnished to the Engineer or Owner before acceptance.
- E. Testing Agencies: Mill certificates of tests on materials made by the manufacturers will be accepted provided the manufacturer maintains an adequate testing laboratory, makes regularly scheduled tests that are spot checked by an outside laboratory, and furnishes satisfactory certificates with the name of the one making the test. Agencies to be used shall be submitted to the Engineer for review prior to engagement.

1.9 SEQUENCING AND SCHEDULING

- A. Arrange work so that section of mains between valves are tested, sterilized, pavement replaced, and the section placed in service as soon as reasonable after it is placed.

1.10 GUARANTEE:

- A. The Contractor shall guarantee the quality of the materials, equipment, and workmanship for a period of 24 months after commissioning the system. Defects discovered during that period shall be repaired by the Contractor at no cost to the Owner. The Performance Bond shall reflect this guarantee.

1.11 PRE-CONSTRUCTION CONFERENCE

- A. The Contractor shall be responsible for coordinating his construction with the Public Utility. A Pre-Installation Meeting shall be held with the Public Utility prior to construction. The Contractor shall notify the Public Utility and Engineer a minimum of 72 hours in advance of the meeting.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. All material or products which come into contact with drinking water shall be third party certified as meeting the specifications of ANSI/NSF 61. The certifying party shall be accredited by the American National Standards Institute.
- B. All pipe, fittings, packing, jointing materials, valves, and fire hydrants shall conform to Section C of the AWWA Standards.
- C. Natural rubber or other material which will support microbiological growth may not be used for any gaskets, O-rings, and other products used for jointing pipes setting meters or valves, or other appurtenances which will expose the material to the water.
- D. Any pipe, solder, or flux which is used in the installation or repair of any public water system, used in any plumbing which provides water through connection to a public water system, for human consumption, shall be lead free. Lead free, for solder and flux, means those containing not more than 0.2% lead. Lead free, for pipes and pipe fittings, as those containing not more than 8.0% lead. Leaded joints necessary for the repair of CIP shall be exempt from the above.

2.2 WATER MAINS & WATER SERVICE LINES

- A. Ductile Iron Pipe
 - 1. ANSI A21.5 (AWWA C150) and ANSI A21.51 (AWWA C151).
 - 2. All 4 inch pipe shall be Class 51, unless noted otherwise.
 - 3. All pipe between 6 to 54 inches shall be Class 50. It shall be cement lined in accordance with ANSI A 21.4 (AWWA C104).
- B. All above ground mains shall be ductile iron pipe as specified.

2.3 JOINTS

- A. Flanged Joints: ANSI A21.15 (AWWA C115).
 - 1. Bolts: ANSI B18.2.1.
 - 2. Nuts: ANSI B 18.2.2.
 - 3. Gaskets: Rubber, either ring or full face, and shall be 1/8 inch thick. Gaskets shall conform to the dimensions recommended by AWWA C115.
- B. DIP Mechanical Joints: ANSI A21.11 (AWWA C111).
- C. DIP Push-on Joints: ANSI A21.11 (AWWA C111).
 - 1. Lubricants which will support microbiological growth shall not be used for slip-on joints. The use of vegetable oil is prohibited.

2.4 FITTINGS

- A. DIP Pipe: AWWA C110 or AWWA C153.
 - 1. Fittings shall be cement lines in accordance with ANSI A21.4 (AWWA C104).
 - 2. Fittings shall be designed to accommodate the type of pipe used.
- B. Flanged Pipe: ANSI B16.1, Class 125 flanges.

2.5 GATE VALVES, BUTTERFLY VALVES, AND VALVE BOXES

- A. Acceptable Manufacturers: Only products of the Mueller company and American Darling Valve Company or equivalent shall be used.
- B. Gate Valves shall be 12 inches or smaller and shall conform to the following:
 - 1. Resilient seat type: AWWA C509.
 - 2. Epoxy coated inside and outside: AWWA C550.
 - 3. Ends shall be mechanical joint: ANSI C111 (AWWA A21.11).
 - 4. Working pressure: 200 psi.
- C. Tapping Valves 12 inches and smaller shall conform to the following:
 - 1. Resilient seat type: AWWA C509.
 - 2. Epoxy coated inside and outside. AWWA C550.
 - 3. Ends shall be flanged by mechanical joint: ANSI B16.1, Class 125 and ANSI C111 (AWWA A21.11) respectively.
 - 4. Working pressure: 200 psi.
- D. Indicator Posts: UL 789; Provide for gate valves where indicated.
- E. Valve Box: ASTM A48, Class 20 Specifications. Valve boxes shall be full cast iron with cast iron covers suitable for heavy traffic use. Valve boxes shall be screw type and have a 5-1/4 inch inside shaft diameter. All parts shall have an asphaltic coating inside and outside with a minimum of 1 mil thickness.
 - 1. Products of Tyler Pipe/Utility Division #6950 Series and Bingham and Taylor #4905 of U.S. Manufacture or equivalent.
- F. Reduced Pressure Backflow Preventer or Double Check Valve Assembly: Any water supply project involving the use of a reduced pressure backflow preventer or double check valve assembly, will not be given final approval for operation until the backflow prevention devices have been tested by a certified tester.
- G. Other Requirements:
 - 1. All valves shall have Grade B cast iron bodies conforming to ASTM A126.
 - 2. All valves shall have a 2 inch square operating nut for buried service.
 - 3. All valves shall have open left operation.
 - 4. All valves shall be equipped with a non-rising stem.
 - 5. All valves shall be constructed with zinc plated steel bolts and nuts.
 - 6. Shall be in conformance with the latest revision of all referenced standards of AWWA or ANSI shall prevail.
 - 7. Valve boxes with drop covers will be of cast iron.

2.6 FIRE HYDRANTS

- A. Only the following companies and products shall be used:
 - 1. Mueller Company (Centurion)
- B. Fire hydrants shall be compression type, opening against pressure and closing with pressure and conform to:
 - 1. AWWA C502 - Dry Barrel Fire Hydrants
- C. Interior shall be two part thermosetting epoxy coated holiday free to a minimum of 4 mils thick conforming to:
 - 1. AWWA C550 - Protective Interior Coatings for Valves and Hydrants
- D. Exterior coating shall be as follows:
 - 1. Hydrant barrel will be painted red.
 - 2. Weather cap, operating nut, and nozzle caps will be painted red.
 - 3. Hydrant parts below ground will be asphaltic coated.
 - 4. An all bronze seat ring shall thread directly into an all bronze drain ring or heavy bronze bushing located between the lower hydrant barrel and shoe securely retained in this position, or it may be threaded into a heavy bronze busing in the hydrant shoe. Drain rings cast into iron body is not acceptable.
 - 5. All bronze or brass internal working parts in contact with service water to be low in zinc content.
- E. Connections between the hydrant and the water main shall be mechanical joints with retained glands conforming to:
 - 1. ANSI/AWWA - Rubber Gasket Joints for Grey Iron and C111/A21.11 Ductile Iron Pressure Pipe and Fittings.
- F. Hydrants shall be wrapped in accordance with:
 - 1. ANSI/AWWA C105/A21.5 - Polyethylene Encasement for Ductile Iron piping for Water and Other Liquids
 - 2. Thickness: 8 mils
- G. Hydrants shall have a 6 inch mechanical joint connection with 5-1/4 inch main valve.
- H. Hydrant shall have 2-1/2 inch hose nozzles and one 4-1/2 inch pumper nozzle with mechanical removal feature, set screws, lock rings, etc., and shall conform to existing national standard specifications and ANSI B26.
- I. Barrel lengths shall generally be for 3-1/2 foot bury.
- J. Hydrants shall open left.
- K. Hydrants shall have a 150 psi working pressure.
- L. Hydrants shall be traffic designed.
- M. Retaining bolts of shoe to lower barrel shall be stainless steel.
- N. Upper assembly shall be provided with a grease or oil reservoir that automatically lubricates all operating stem threads and bearing surfaces each time of operation. The system shall be completely sealed from the waterway and external contaminants. The reservoir is to have an external filler point that does not require dismantling any portion of the hydrant during regular maintenance.

- O. Casting shall indicate type, design, and date manufacturer.
- P. All fire hydrants shall be tested to 300 psi test pressure before shipping.
- Q. All fire hydrant leads shall include 6 inch mechanical joint gate valve attached to the 6 inch side outlet of the mainline tee by means of an anchoring coupling with a laying length of 12 inches.

2.7 SERVICE CONNECTIONS

- A. Taps in pipe larger than 3 inches shall be made with a tapping machine. A corporation stop shall be installed at the connection to the main. The corporation stop shall be brass manufactured in conformance with AWWA C800, General, Section No. 1, Paragraph 1.2. Inlet and outlet threads shall conform to AWWA C800.
 - 1. Taps for house services in PVC pipe shall be made with full circle double strap bronze service saddle. The connection shall be capable of withstanding a continuous internal pressure of 150 psi.
 - 2. The key and body seating surfaces shall be accurately machined and fit to a taper of 1-3/4 inches per foot. The stem and retaining nut shall be so designed that failure from overtightening of the retaining nut results in thread stripping rather than stem fracture. Corporation stops shall be 1 inch equal to Hays 5200 CF with a stainless steel stiffener. Service saddles shall have 1 inch AWWA taps, equal to Ford Styles 202B or S70. Contractor shall adhere to pipe manufacturer's recommendations on maximum tap sizes for each main size.
- B. Where connections to larger service pipes are required, multiple taps shall be made and connected by branch. Taps for house services in PVC pipe 2 inches and smaller shall be made with a Dresses "Quick Tap" or a PVC Tee. The connection shall be continuously at 150 psi. House service lines will be 1 inch plastic with a curb stop at the property line. The end of the service lateral at the property line shall be marked with a stake, as shown on the detail, 36 inches long with the top 6 inches above the ground and painted blue. The depth of the pipe shall be marked on the back of the stake.

2.8 TAPPING SLEEVES/CROSSES

- A. Shall be mechanical joint type sized to fit the intercepted pipe. They shall have duck-tipped end gaskets and shall be equal to Mueller H-615/715 with a tapping valve attached. The outlet end of the valve shall have a joint suitable for the type of pipe to be used in the new branch. The Sleeve/Cross shall be sized to fit the intercepted pipe without leaking.

2.9 METAL DETECTOR TAPE

- A. Will be used over all non-metallic pipe. The tape shall be laid 18 inches from finished grade and shall consist of 0.35 mils thick solid soil core encased in a protective plastic jacket that is resistant to alkalis, acids, and other destructive elements found in the soil. The lamination bond shall be strong enough that the layers cannot be separated by hand. Total composite thickness to the 5.0 mils. Foil core to be visible from unprinted side to ensure continuity. The tape shall have a minimum 3 inch width and a tensile strength of 84 pounds per three inch wide strip.
- B. A continuous warning message repeated every 16" to 36" shall be imprinted on the tape surface. The tape shall contain an opaque color concentrate designating the color code appropriate to the line being buried (Water Systems - Safety Precaution Blue; Sewer Systems - Safety Green)

2.10 BOLTS, NUTS, AND ALL-THREAD ROD

- A. Bolts, nuts, and all-thread rod shall be made of either high-strength cast iron containing a minimum of 0.50 percent copper, or high-strength low-carbon steel per ASTM A307, specifications for carbon steel externally threaded standard features, Grade B, having a minimum yield strength of 45,000 psi.

- B. Stainless steel materials shall contain sufficient chromium to resist corrosion, oxidation, and rust.
- C. Materials shall be sound, clean, and coated with a rust resistant lubricant.
- D. Threads shall be in accordance with ANSI B1.1, Unified Inch Screw Threads, and with B1.2, Screw Threads, Gages, and Gaging, conforming to the coarse thread series (UNC) Unified Chords, with threads Class 2A internal and Class 2B external.
- E. Bolts $\frac{3}{4}$ " and smaller shall be furnished with heavy hex heads conforming to ANSI B18.2.1
- F. Bolts larger than $\frac{3}{4}$ " may have either standard or heavy hex heads conforming to ANSI B18.2.1

2.11 POLYETHELENE ENCASEMENT

- A. Conforms to ANSI 21.5 (AWWA C105)
- B. 8 mil Polyethylene Tube

2.12 STEEL CASING FOR HIGHWAY CROSSING

- A. ASTM A139, Grade steel pipes primed and coated with a hot coal tar enamel a minimum of $\frac{3}{32}$ inches thick. Only new primed and coated pipe shall be used.
- B. The pipe shall have a minimum inside diameter and a minimum wall thickness as specified by the Engineer. The Engineer shall be responsible for determining if the minimum sizes and thickness shown on the approved drawings are adequate for placing the casing under the highway and for installing the carrier pipe.

2.13 BEDDING AND BACKFILL MATERIAL

- A. Crushed stone and gravel conforming to ASTM C33, Gradation 67 ($\frac{3}{4}$ " to No. 4)
- B. Clean, well graded Class II and/or Class III soils. Class IV and Class V materials are not allowed. Refer to SECTION "EARTH MOVING" a description of classes.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Refer to Section 312000 "Earth Moving" for excavating, trenching, backfilling, and testing for utilities.

3.2 GENERAL INSTALLATION

- A. No flushing devices shall be directly connected to any sewer.
- B. Chambers, pits, or manholes containing valves, blow-offs, meters, air relief valves, other such appurtenances to a distribution system, shall not be connected directly to any storm drain or sanitary sewer.
- C. Installation of water mains and appurtenances shall be conducted in accordance with Section C of the AWWA Standards and/or manufacturer's recommended installation procedures.
- D. All water mains shall be provided with a minimum of 30 inches of cover, unless pipe material is steel, concrete, DIP, or other approved material, and if exposed should be insulated to prevent freezing.
- E. All tees, bends, plugs, and hydrants on lines 2.5 inches in diameter and larger shall be provided with reaction blocking, tie rods, or other approved method of restraint.
- F. These requirements shall apply to all pipeline installation except where otherwise specified herein.

- G. Terminate the work covered by this section at a point approximately 5 feet from the building, unless otherwise indicated.
 - 1. Where the location of the water line is not clearly defined by dimensions on the drawings, do not lay water line closer horizontally 10 feet from any sewer line.
 - 2. Where water lines cross under gravity sewer lines, encase sewer line fully in concrete for a distance of at least 10 feet on each side of the crossing, unless sewer line is made of pressure pipe with rubber-gasketed joints and no joint is located within 3 feet horizontally of the crossing.
 - 3. Lay water lines which cross sewer force mains and inverted siphons at least 2 feet above these sewer lines; when joints in the sewer line are closer than 3 feet horizontally from the water line, encase these joints in concrete.
 - 4. Do not lay water lines in the same trench with gas lines, fuel lines or electric wiring.

3.3 WATER PIPING INSTALLATION PARALLEL WITH SEWER PIPING

- A. Normal Conditions: Lay water piping at least 10 feet horizontally from a sewer or sewer manhole whenever possible. Measure the distance edge-to-edge.
- B. Unusual Conditions: When local conditions prevent a horizontal separation of 10 feet, the water piping may be laid closer to a sewer or sewer manhole provided that:
 - 1. The bottom (invert) of the water piping shall be at least 18 inches above the top (crown) of the sewer piping.
 - 2. Where this vertical separation cannot be obtained, the sewer piping shall be constructed of AWWA-approved water pipe and pressure tested in place without leakage prior to backfilling.
 - 3. The sewer manhole shall be of watertight construction and tested in place.

3.4 WATER PIPING INSTALLATION CROSSING SEWER PIPING

- A. Normal Conditions: Water piping crossing above sewer piping shall be laid to provide a separation of at least 18 inches between the bottom of the water piping and the top of the sewer piping.
- B. Unusual Conditions: When local conditions prevent a vertical separation described above, use the following construction:
 - 1. Sewer piping passing over or under water piping shall be constructed of AWWA-approved water piping, pressure tested in place without leakage prior to backfilling.
 - 2. Water piping passing under sewer piping shall, in addition, be protected by providing a vertical separation of at least 18 inches between the bottom of the sewer piping and the top of the water piping; adequate structural support for the sewer piping to prevent excessive deflection of the joints and the settling on and breaking of the water piping; and that the length, minimum 18 feet, of the water piping be centered at the point of the crossing so that joints shall be equidistant and as far as possible from the sewer piping
 - 3. Sewer Piping or Sewer Manholes: No water piping shall pass through or come in contact with any part of a sewer manhole.

3.5 BACKFILLING AND COMPACTION

- A. The backfilling of pipeline trenches shall be started immediately after the pipe work has been inspected.
 - 1. Bedding: A continuous and uniform bedding shall be provided in the trench for all buried pipe.

2. The initial backfill material, placed to a height of 1-foot above the top of the pipe, shall consist of approved backfill material free from organic matter and deleterious substances, containing no rocks or lumps over 2-inch in any dimension. The material shall not contain any debris that might cause damage to the pipe or that might prevent proper compaction of the backfill.
 3. Material shall be carefully placed and compacted throughout the entire area to be backfilled. Backfill shall be deposited in 6-inch layers (before compaction) and thoroughly compacted with power tools to 95% of theoretical maximum density, modified Proctor ASTM-D-1557.
 4. Backfill material must be tamped in layers around the pipe and to a sufficient height above the pipe to adequately support and protect the pipe.
- B. All backfilling shall be done in such a manner as will not disturb or injure the pipe or structure over or against which it is being placed. Any pipe or structure injured, damaged or moved from its proper line or grade during backfilling operations shall be uncovered, repaired, and then re-backfilled as herein specified.
1. Whenever the trenches have not been properly filled, or if settlement occurs, they shall be refilled, smoothed off and made to conform to the surface of the ground. Backfilling shall be carefully performed, and the original surface restored to the full satisfaction of the Engineer immediately after installation.
- C. Where pipe trenches are cut across or along pavement, the trenches shall be backfilled in accordance with applicable permits.
- D. Backfilling around structures shall be done in the manner specified above for pipe trenches by power tamping for the full depth of cut from the bottom of the finished grade.
- E. All excavations suspected of not meeting compaction requirements shall be re-tested. Tests shall be performed at the locations and depths directed by the Engineer. Tests shall be at the expense of the installing contractor.

3.6 REMOVE FINS AND BURRS FROM PIPE AND FITTINGS

- A. Before placing in position, clean pipe, fittings, valves, and accessories, and maintain in a clean condition. Provide proper facilities for lowering sections of pipe into trenches. Do not under any circumstances drop or dump pipe, fittings, valves, or any other water line material into trenches. Cut pipe accurately to length established at the site and work into place without springing or forcing. Replace by one of the proper length any pipe or fitting that does not allow sufficient space for proper installation of jointing material. Blocking or wedging between bells and spigots will not be permitted. Lay bell-and-spigot pipe with the bell end pointing in the direction of laying. Grade the pipeline in straight lines; avoid the formation of dips and low points. Support pipe at proper elevation and grade. Secure firm, uniform support. Wood support blocking will not be permitted. Lay pipe so that the full length of each section of pipe and each fitting will rest solidly on the pipe bedding; excavate recesses to accommodate bells, joints, and couplings. Provide anchors and supports where indicated and where necessary for fastening work into place. Make proper provision for expansion and contraction of pipelines. Keep trenches free of water until joints have been properly made. At the end of each work day, close open ends of pipe temporarily with wood blocks or bulkheads. Do not lay pipe when conditions of trench or weather prevent installation.

3.7 INSTALLATION OF TRACER WIRE

- A. All water mains shall be detectable within 3 feet with electronic locating equipment. Install a continuous length of tracer wire for the full length of each run of non-metallic pipe. Attach wire to top of pipe in such manner that it will not be displaced during construction operations.

3.8 INSTALLATION OF DUCTILE IRON WATER MAINS AND FITTINGS

- A. Unless otherwise specified, install pipe and fittings in accordance with paragraph entitled "General Installation " and with the requirements of AWWA C600 for pipe installation, joint assembly, valve-and-fitting installation, and thrust restraint.
- B. Jointing:
 - 1. Make push-on joints with the gaskets and lubricant specified for this type joint; assemble in accordance with the applicable requirements of AWWA C600 for joint assembly.
 - 2. Make mechanical joints with the gaskets, glands, bolts, and nuts specified for this type joint; assemble in accordance with the applicable requirements of AWWA C600 for joint assembly and the recommendations of Appendix A to AWWA C111/A21.11.
 - 3. Make flanged joints with the gaskets, bolts, and nuts specified for this type joint. Make flanged joints up tight; avoid undue strain on flanges, fittings, valves, and other equipment and accessories. Align bolt holes for each flanged joint. Use full size bolts for the bolt holes; use of undersized bolts to make up for misalignment of bolt holes or for any other purpose will not be permitted. Do not allow adjoining flange faces to be out of parallel to such degree that the flanged joint cannot be made watertight without overstraining the flange. When flanged pipe or fitting has dimensions that do not allow the making of a proper flanged joint as specified, replace it by one of proper dimensions. Use set screwed flanges to make flanged joints where conditions prevent the use of full-length flanged pipe and assemble in accordance with the recommendations of the set screwed flange manufacturer.
 - 4. Assemble joints made with sleeve-type mechanical couplings in accordance with the recommendations of the coupling manufacturer.
- C. Exterior Protection: Completely encase buried ductile iron pipelines with polyethylene tube or sheet, using Class A polyethylene film, in accordance with AWWA C105/A21.5.

3.9 THRUST RESTRAINT

- A. All tees, plugs, caps and bends which are equal to or greater than 11-1/4 degrees and equal to or greater than 4 inches in diameter shall be provided with adequate thrust restraint using either thrust blocking, restrained joint or a combination of both.
 - 1. Thrust blocking shall bear directly against the undisturbed trench wall and shall be made of 3,000 psi concrete. Place the blocking so that the pipe and fittings will be accessible to repairs or reworking joints as may become necessary.
 - 2. EBBA Iron Sales, Megalug retainer glands or equivalent may be used in lieu of thrust blocking or in combination with thrust blocking where appropriate or as indicated by the Engineer.

3.10 INSTALLATION OF VALVES

- A. Install gate valves, AWWA C500 and UL 262, in accordance with the requirements of AWWA C600 for valve-and-fitting installation and with the recommendations of the Appendix ("Installation, Operation, and Maintenance of Gate Valves") to AWWA C500.
- B. Install gate valves, AWWA C509, in accordance with the requirements of AWWA C600 for valve-and-fitting installation and with the recommendations of the Appendix ("Installation, Operation, and Maintenance of Gate Valves") to AWWA C509.
- C. Install gate valves on PVC water mains in accordance with the recommendations for appurtenance installation in AWWA M23, Chapter 7, "Installation."
- D. Install check valves in accordance with the applicable requirements of AWWA C600 for valve-and-fitting installation, except as otherwise indicated.

- E. Make and assemble joints to gate valves and check valves as specified for making and assembling the same type joints between pipe and fittings

3.11 INSTALLATION OF HYDRANTS

- A. Install hydrants, except for metal harness, in accordance with AWWA C600 for hydrant installation and as indicated.
- B. Make and assemble joints as specified for making and assembling the same type joints between pipe and fittings.
- C. Provide metal harness as specified under pipe anchorage requirements for the respective pipeline material to which hydrant is attached.
- D. A concrete block 1'x1'x2' shall be poured between the back of the hydrant and undisturbed earth of the trench side

3.12 INSTALLATION OF BACKFLOW PREVENTION DEVICES

- A. There shall be no connection between the distribution system and any pipes, pumps, hydrants, or tanks whereby unsafe water or other contamination materials may be discharged or drawn into the system.
- B. No by-passes shall be allowed, unless the bypass is also equipped with an equal, approved backflow prevention device.
- C. High hazard category cross connections shall require an air gap separation or an approved reduced pressure backflow preventer.
- D. Reduced pressure principal backflow prevention assemblies shall not be installed in any area location subject to possible flooding. This includes pits or vaults which are not provided with a gravity drain to the ground's surface that is capable of exceeding the discharge rate of the relief valve. Generally, if installed in a pit, the drain line shall be 2 times the size of the line entering the backflow prevention device. The drain cannot empty into any type of ditch, storm drain, or sewer, which could flood water back into the pit.
- E. All piping up to the inlet to the backflow prevention device must be suitable for potable water. The pipe must be AWWA or NSF approved. Black steel pipe cannot be used on the inlet side of the device.
- F. Fire line sprinkler systems and dedicated fire lines, except those in the high hazard category shall be protected by an approved double check valve assembly.

3.13 INSTALLATION OF METALLIC WATER SERVICE PIPING

- A. Install pipe and fittings in accordance with paragraphs entitled "General Installation" and "Installation of Water Service Piping" and with the applicable requirements of AWWA C600 for pipe installation, unless otherwise specified.
- B. Screwed Joints
 - 1. Make screwed joints up tight with a stiff mixture of graphite and oil, inert filler and oil, or graphite compound; apply to male threads only.
 - 2. Threads shall be full cut; do not leave more than three threads on the pipe exposed after assembling the joint.
- C. Joints for Copper Tubing
 - 1. Cut copper tubing with square ends; remove fins and burrs.
 - 2. Handle tubing carefully; replace dented, gouged, or otherwise damaged tubing with undamaged tubing.

3. Make solder joints using ASTM B 32, 95-5 tin-antimony or Grade Sn96 solder.
4. Solder and flux shall contain not more than 0.2 percent lead.
5. Before making joint, clean ends of tubing and inside of fitting or coupling with wire brush or abrasive. Apply a rosin flux to the tubing end and on recess inside of fitting or coupling.
6. Insert tubing end into fitting or coupling for the full depth of the recess and solder.
7. For compression joints on flared tubing, insert tubing through the coupling nut and flare tubing.

D. Flanged Joints

1. Make flanged joints up tight, taking care to avoid undue strain on flanges, valves, fittings, and accessories.

3.14 PROTECTION

- A. Shoring and Sheet piling: The Contractor is responsible for the design of all shoring and sheet piling systems. Provide shoring, bracing or sheet piling where required. In addition to the requirements of Section 25 A and B of COE EM-385-1-1, and other requirements of this contract meet the following:

1. Prevent the undermining of pavements, foundations and slabs.
2. Slope banks where space permits.
3. Where shoring and sheet piling materials remain in place in completed work to prevent settlements or damage to adjacent structures as directed, backfill the excavation to 3 feet below the finished grade and remove the remaining portion of the shoring before completing the backfill.

- B. Drainage and Dewatering: Plan for and provide structures, equipment and construction for the collection and disposal of surface and subsurface water encountered during construction.

1. Drainage

- a. Dispose of surface water which may accumulate in open excavations, unfinished fills, or other low areas. Remove water by trenching where approved, pumping, or other methods to prevent softening of exposed surfaces. Surface dewatering plans shall include rerouting of any storm water runoff or natural drainage if necessary. Collect and dispose of surface and subsurface water encountered in the course of construction.

2. Dewatering

- a. Groundwater flowing toward or into excavations shall be controlled to prevent sloughing or excavation slopes and walls, boils, uplift and heave in the excavation and to eliminate interference with orderly progress of construction. French drains, sumps, ditches or trenches will not be permitted within 3 feet of the foundation of any structure, except with specific written approval, and after specific contractual provisions for restoration of the foundation area have been made. Control measures shall be taken by the time the excavation reaches the water level in order to maintain the integrity of the in situ material. While the excavation is open, the water level shall be maintained continuously, at least 1 foot below the working level.
- b. Operate the dewatering system continuously, 24 hours per day, 7 days per week until construction work below existing water levels is complete. Have a back-up pump and system available for immediate use.

C. Erosion Control

1. Protect existing streams, ditches, and storm drain inlets from water-borne soil by the means indicated on the drawings.

D. Existing Utilities

1. All known utility facilities are shown schematically on the drawings and are not necessarily accurate in location as to plan or elevation. Utilities such as service lines or unknown facilities not shown on drawings will not relieve the Contractor of his responsibility under this requirement. "Existing Utilities Facilities" means any utility that exists on the project in its original, relocated or newly installed position. The Contractor will be held responsible for the cost of repairs to damaged underground facilities; even when such facilities are not shown on the drawings.
2. The Contractor shall contact all utility companies prior to beginning work and request accurate field location of their respective utility lines.
3. Movement of construction machinery and equipment over pipes during construction shall be at the Contractor's risk. Repair or remove and provide new pipe for existing or newly installed pipe that has been displaced or damaged.

E. Structures and surfaces

1. Graded areas shall be protected from traffic, erosion, settlement, or any washing away that may occur from any cause prior to acceptance.
2. Any repair or re-establishment of final grades shall be made prior to final acceptance.

F. Disposal of Excavated Materials

1. Dispose of excavated material so that it will not obstruct the flow of runoff, streams, endanger a partly finished structure, impair the efficiency or appearance of any facilities, or be detrimental to the completed work.

3.15 REMOVE AND REPLACE PAVEMENT

- A. Pavement shall only be removed after prior written authorization by the Owner. Pavement removed and replaced shall be done in accordance with the latest specifications of the State Department of Transportation. Traffic shall be maintained and controlled by means of flagmen as necessary.
- B. The edges of pavement shall be cut to a neat straight line with a masonry saw. The backfill shall be compacted and tested and a new pavement section provided as indicated on the drawings.

3.16 ACCEPTANCE OF PORTIONS OF THE WORK

- A. The Owner reserves the right to accept and use any portion of the work whenever it is considered to his interest to do so. The Engineer shall have power to direct on what line the Contractor shall work and the order thereof.

3.17 INSPECTIONS

- A. Notify the Owner, Project Representative, Engineer and Authority Having Jurisdiction (AHJ) a minimum of 72 hours prior to all required observations, inspections or tests.
- B. The Engineer will have the right to require that any portion of the work be done in his presence and if the work is covered up after such instruction, it shall be exposed by the Contractor for observation.
 1. However, if the Contractor notifies the Engineer that such work is scheduled, and the Engineer fails to appear within 72 hours, the Contractor may proceed without him.

- C. All work completed and materials furnished shall be subject to review by the Engineer or the Project Representative.
- D. All improper work shall be reconstructed and all materials which do not conform to the requirements of the specifications shall be removed from the work upon written notice.
 - 1. The Engineer shall have the right to mark materials as rejected to distinguish them as such.

3.18 TESTING

- A. All testing shall be made at the Owner's expense.
 - 1. Test locations shall be approved by the Engineer.
- B. The Testing Laboratory, Engineer and Owner shall be given a 72 hour notice, minimum, prior to all required tests.
- C. Test results shall be furnished to the Contractor, Engineer and Owner within 72 hours after tests are taken.
- D. Independent Testing Laboratory
 - 1. Independent Testing laboratory shall operate in accordance with ASTM E329 and shall be submitted to the Engineer for approval.
 - 2. Independent Testing Laboratory shall prepare test reports that indicate test location, elevation data, and test results.
 - 3. If any test performed fails to meet these specifications, Independent Testing Laboratory shall immediately notify the Owner, Engineer and Contractor.
 - 4. The Owner reserves the right to employ an Independent Testing Laboratory and to direct any testing that it may deem necessary.
 - a. The Contractor shall provide free access to the site for testing activities.
- A. Field Testing
 - 1. Density tests for in-place materials shall be performed in accordance with one of the following:
 - a. Sand Cone Method: ASTM D 1556
 - b. Balloon Method: ASTM D 2167
 - c. Nuclear Method: ASTM D 6938
 - 2. Frequency of Field Testing
 - a. Subgrade
 - 1) One test per 100 LF of utility trench; minimum of 1 test per run between utility structures.
 - 2) One test per utility structure.
 - b. Fill and Backfill
 - 1) One test per 100 LF per lift of utility trench; minimum of 1 test per lift per run between utility structures.
 - 2) One test per utility structure per lift.
- B. Test Reports

1. Test results shall be furnished to the Contractor, Engineer and Owner within 72 hours after field tests are taken.
2. Test reports prepared by the Independent Testing Laboratory shall prepare indicate test location, elevation data, and test results.
3. If any test performed fails to meet these specifications, Independent Testing Laboratory shall immediately notify the Owner, Engineer, and Contractor.
4. The Owner reserves the right to employ an Independent Testing Laboratory and to direct any testing that it may deem necessary. The Contractor shall provide free access to the site for testing activities.

C. Bacteriological Testing (Disinfection)

1. After the hydrostatic and leakage tests have been completed, water pipes shall be disinfected in accordance with AWWA C651 and the regulations of the local health department.
2. In general one approved method referred to as "continuous feed method" is as follows:
 - a. Before being placed in service, all new mains shall be thoroughly flushed then chlorinated with not less than twenty-five (25) milligrams per liter of available chlorine.
 - b. Water from the existing distribution system or other source of supply shall be controlled so as to flow slowly into the newly laid pipeline during the application of chlorine.
 - c. The solution shall be retained in the pipeline for not less than twenty-four (24) hours and then flushed thoroughly with a potable water of satisfactory bacteriological quality before starting the sampling program.
3. The contractor shall collect a minimum of two (2) samples from each sampling site for total coliform analysis. The number of sites depends on the amount of new construction but must include all dead-end lines, be representative of the water in the newly constructed mains, and shall be collected a minimum of every 1,200 linear feet.
4. Prior to sampling, the chlorine residual must be reduced to normal system residual levels or be non-detectable in those systems not chlorinating.
5. These samples must be collected at least twenty-four (24) hours apart and must show the water line to be absent of total coliform bacteria.
6. The chlorine residual must also be measured and reported.
7. If the membrane filter method of analysis is used for the coliform analysis, non-coliform growth must also be reported.
8. If the non-coliform growth is greater than eighty (80) colonies per one hundred (100) milliliters, the sample result is invalid and must be repeated.
9. All samples must be analyzed by a State certified laboratory.
10. The Owner and Engineer shall be provided copies of each report within 72 hours of the time the test was performed.
11. NCDEQ only considers these tests valid for a 30-day period.
 - a. The Contractor is responsible for coordinating testing schedules with the Engineer and Utility in a manner to ensure that all associated closeout documentation (as-built drawings, easement plats, waiver of liens, etc.) can be finalized within 30 days of the tests.
 - b. The Engineer shall be given a minimum of one week for review of the tests.

- c. All additional work, which is the result of expired tests, shall be performed by the Contractor at no additional cost to the Owner.

D. Hydrostatic and Leakage Tests

1. The Engineer **must** witness and approve the following tests. The Engineer requires a minimum of 72 hours written notice prior to these tests.
2. The pipe shall be tested at 1.5 times the working pressure in accordance with AWWA C600, Section 4 - Hydrostatic Testing. However, in no case will test pressure be less than 150 psi. Allowable leakage shall not exceed that determined by the formulas:
 - a. Ductile Iron:
 - 1) $L = SDP^{1/2} / 133,200$, where L = allowable leakage (gal/hr)
 - 2) S = length of pipe tested (ft)
 - 3) D = nominal diameter of pipe (in)
 - 4) P = leakage test pressure (psig)
 - b. PVC:
 - 1) $L = NDP^{1/2} / 7,400$, where L = allowable leakage (gal/hr)
 - 2) N = # of joints in pipe tested (ft)
 - 3) D = nominal diameter of pipe (in)
 - 4) P = leakage test pressure (psig)
3. The test shall be conducted for at least two hours and a pressure of 150 psi shall be maintained during the test
4. Should any test of the pipe laid disclose leakage greater than the above specified, the Contractor shall at his own expense, locate and repair the defective joints until leakage is within the specified allowance. The Contractor is responsible for notifying the Engineer 72 hours (minimum) prior to applying pressure for testing. Pressure test will be witnessed by the Engineer or his authorized representative.

3.19 OPERATIONAL CLOSEOUT DOCUMENTATION

A. As-Built (Record) Drawings

1. Upon completion of installation of the potable water system, a Land Surveyor registered in the State of North Carolina shall prepare and provide Preliminary Record Drawings to the Engineer for review.
 - a. As a minimum, these drawings shall show all pipe sizes, materials, valves, fittings, fire hydrants, and pertinent data input as attributes as required by Town of Canton and tied to State Plane Coordinates.
 - b. Record drawings shall accommodate both the Surveyor's and the Engineer's certifications, seals, and signature.
2. After review by the Engineer and Town of Canton the Surveyor shall make all required changes and/or revisions and submit to the Engineer signed and sealed sets along with electronic media.

B. Easement Plats

1. Upon completion of installation of the potable water system, a Land Surveyor registered in the State of North Carolina shall prepare and provide Preliminary Easement Plats and

Legal Description(s) as required by the Town of Canton and for recording at the appropriate County RMC Office.

- a. Easement Plats shall be tied to State Plane Coordinates.
2. After review by the Engineer and the Town of Canton, the surveyor shall make all required changes and/or revisions.
3. The surveyor shall be responsible for recording the plat(s) at the appropriate County RMC Office, unless instructed otherwise.
4. The Surveyor is required to provide to the Engineer signed and sealed sets with recording information, along with electronic media.
5. Contractor shall include in his project schedule 30 calendar days for the approval of the easement plat by the Utility after incorporation of Engineer's comments.

3.20 ACCEPTANCE

- A. Final acceptance will be based on satisfactory materials, installation and construction of the specified work as approved by the Engineer. All construction shall be re-worked to the satisfaction of the Public Utility, Owner and Engineer until specified requirements are met.
- B. All additional work, which is the result of a failed inspection, shall be performed by the Contractor at no additional cost to the Owner.

END OF SECTION 331100